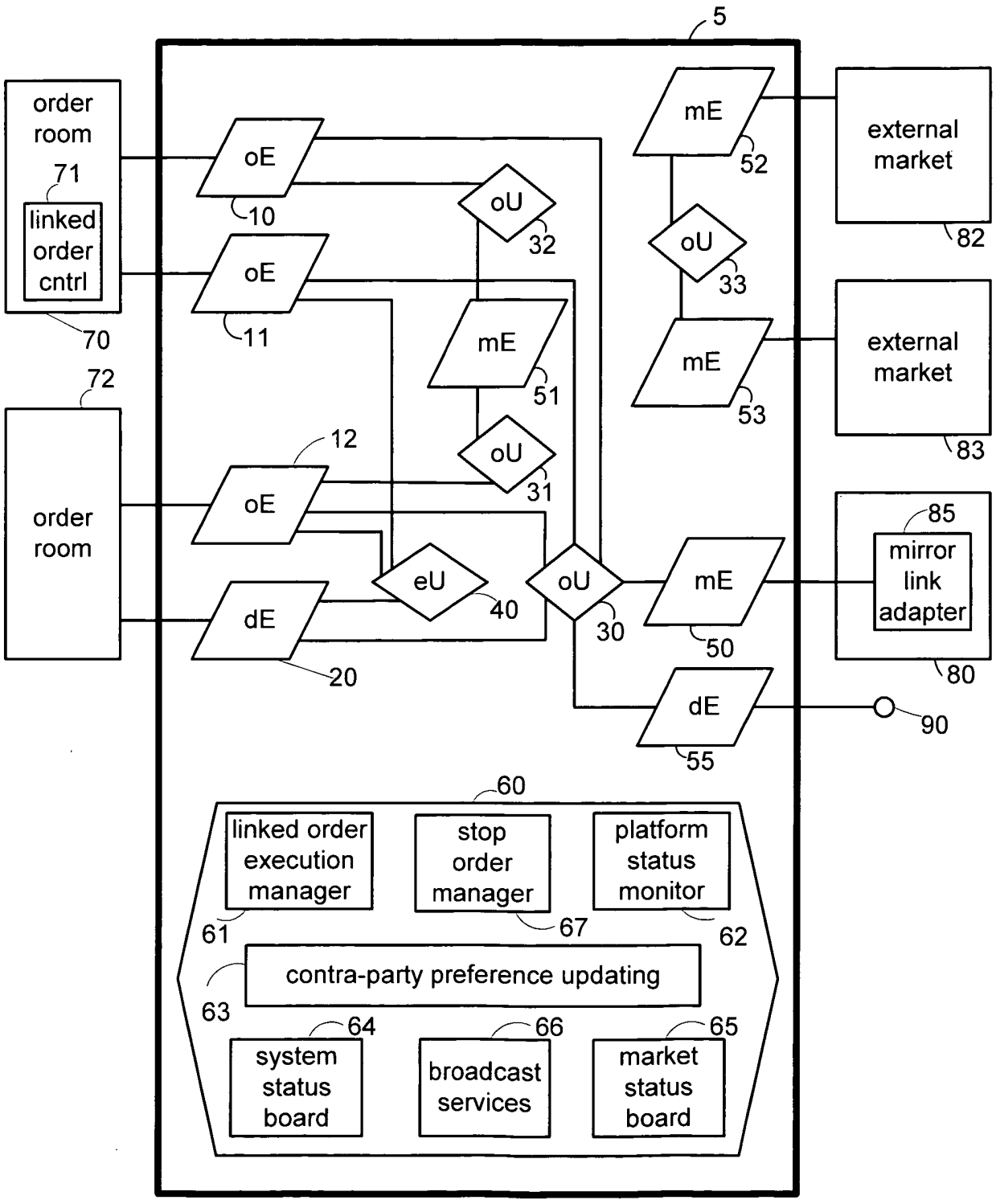

5
order room
71
linked order cntrl
70
72
order room
oE
10
oE
11
oE
12
dE
20
oU
32
mE
51
oU
31
eU
40
oU
30
mE
52
oU
33
mE
53
mE
50
dE
55
external market
82
external market
83
85
mirror link adapter
80
90
60
linked order execution manager
61
stop order manager
67
platform status monitor
62
contra-party preference updating
63
64
system status board
66
broadcast services
65
market status board

FIG. 1

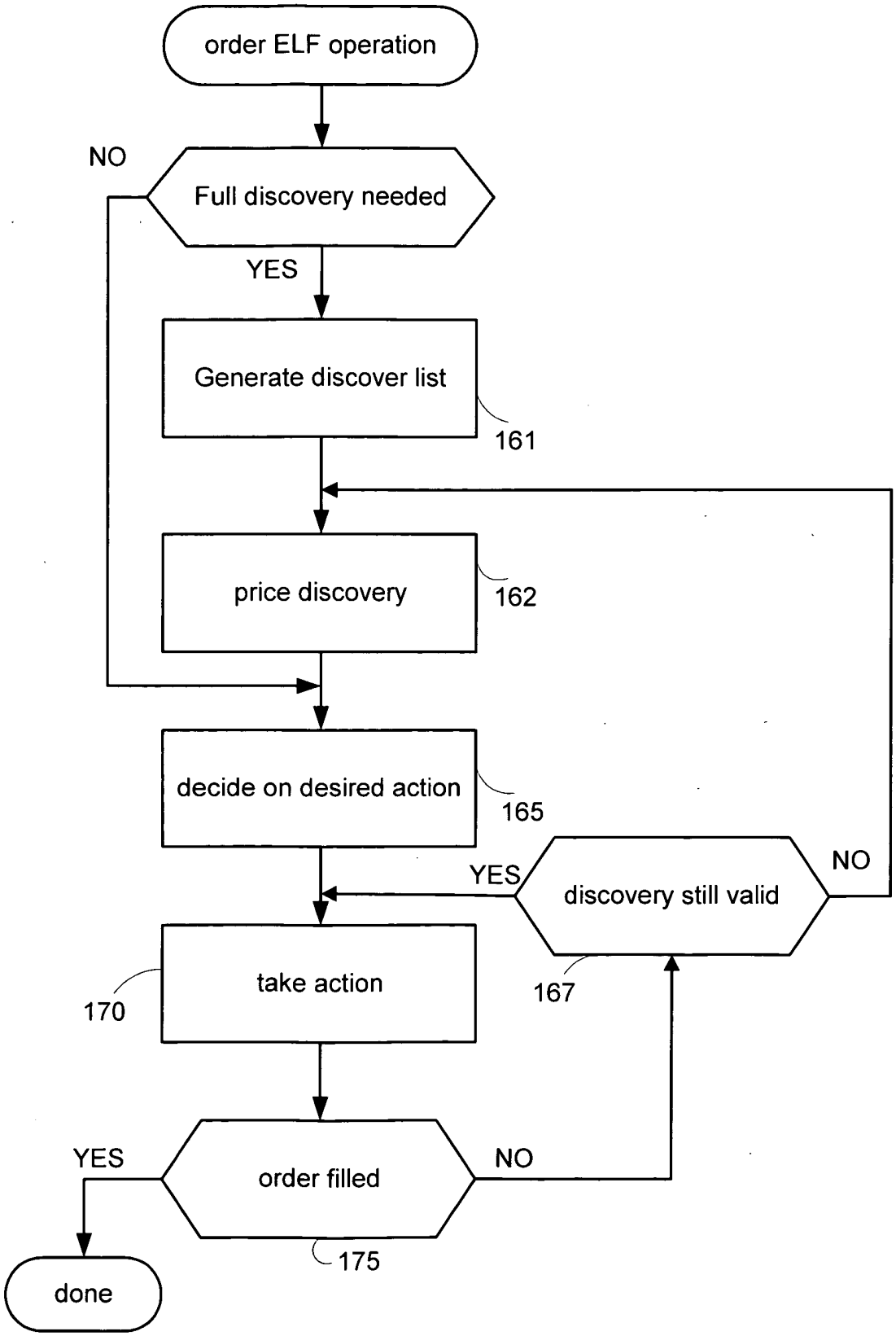

order ELF operation
NO
Full discovery needed
YES
Generate discover list
161
price discovery
162
decide on desired action
165
YES
discovery still valid
NO
167
take action
170
YES
order filled
NO
175
done

FIG. 2

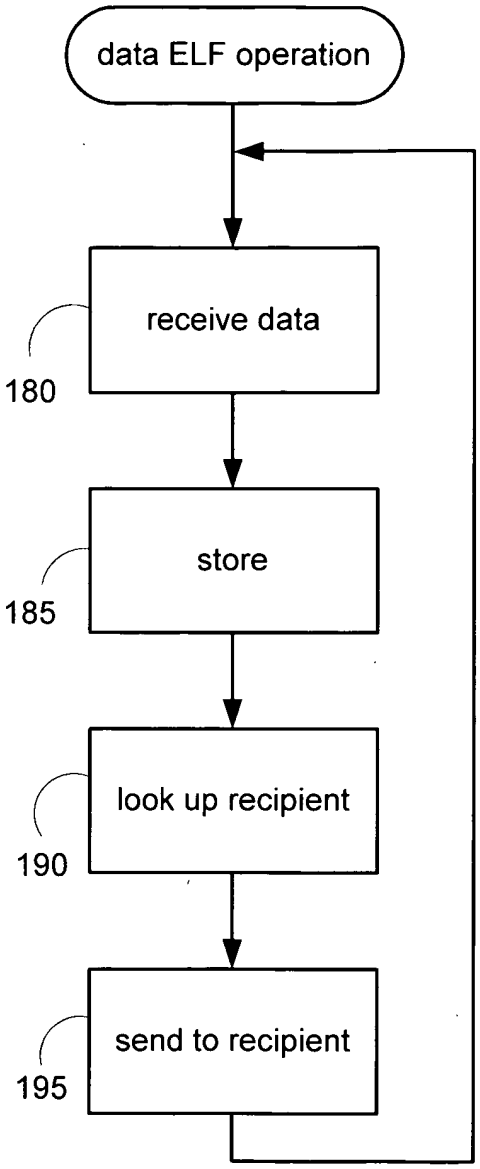

data ELF operation
receive data
180
store
185
look up recipient
190
send to recipient
195

FIG. 3

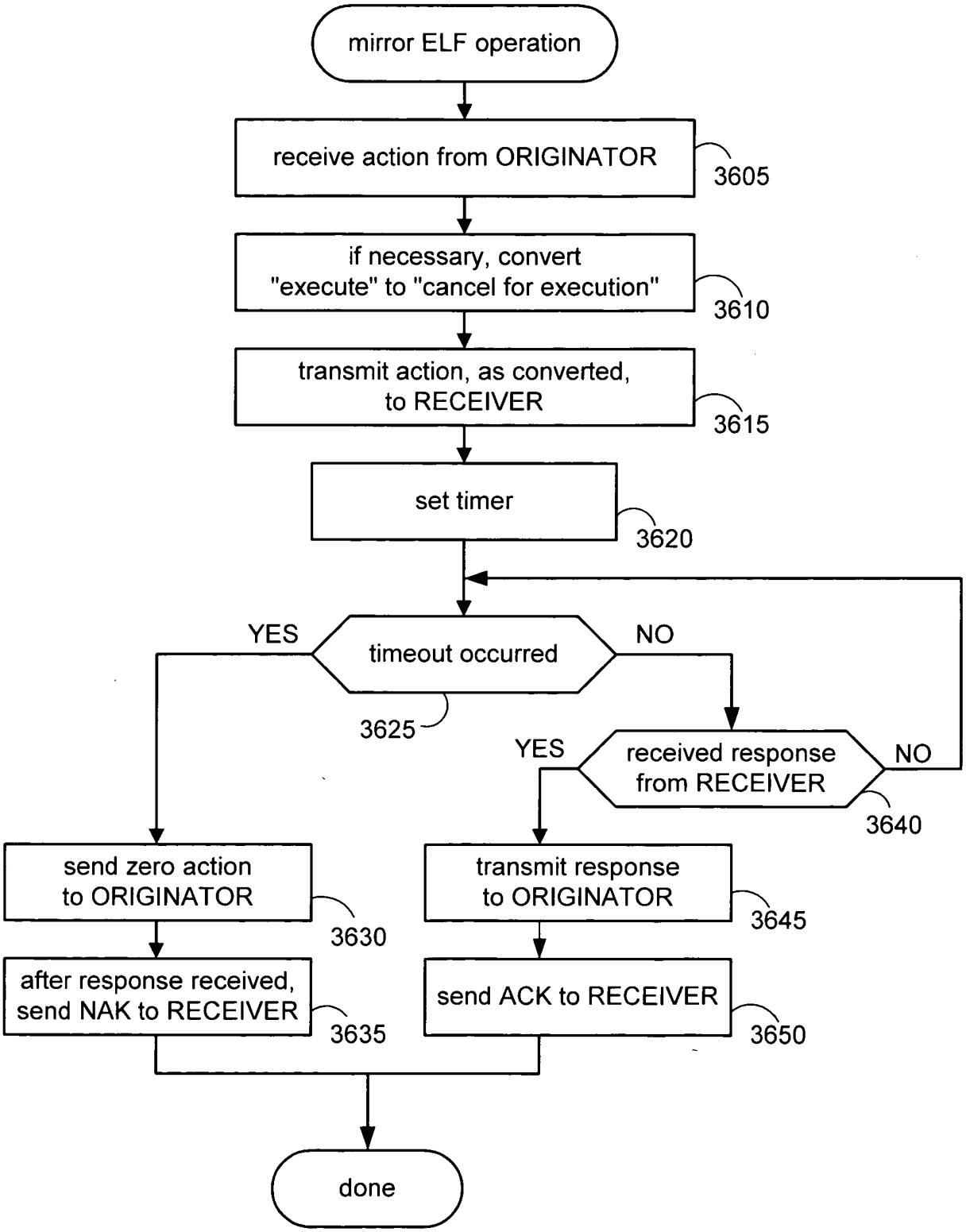

mirror ELF operation
receive action from ORIGINATOR
3605
if necessary, convert "execute" to "cancel for execution"
3610
transmit action, as converted, to RECEIVER
3615
set timer
3620
YES
timeout occurred
NO
3625
YES
received response from RECEIVER
NO
3640
send zero action to ORIGINATOR
3630
transmit response to ORIGINATOR
3645
after response received, send NAK to RECEIVER
3635
send ACK to RECEIVER
3650
done

FIG. 4

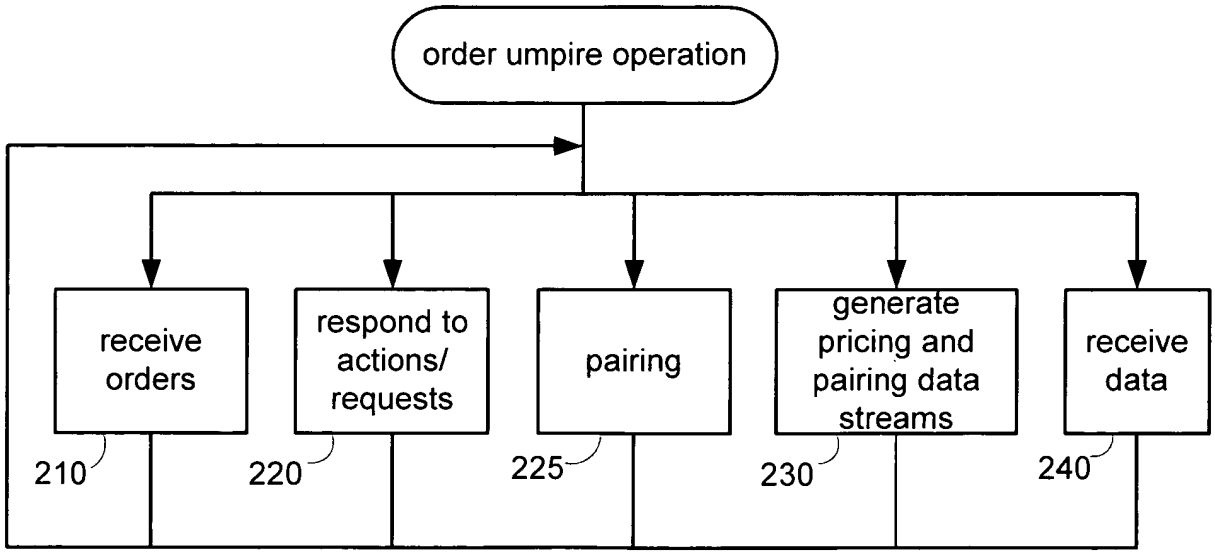

order umpire operation
receive orders
respond to actions/ requests
pairing
generate pricing and pairing data streams
receive data
210
220
225
230
240

FIG. 5

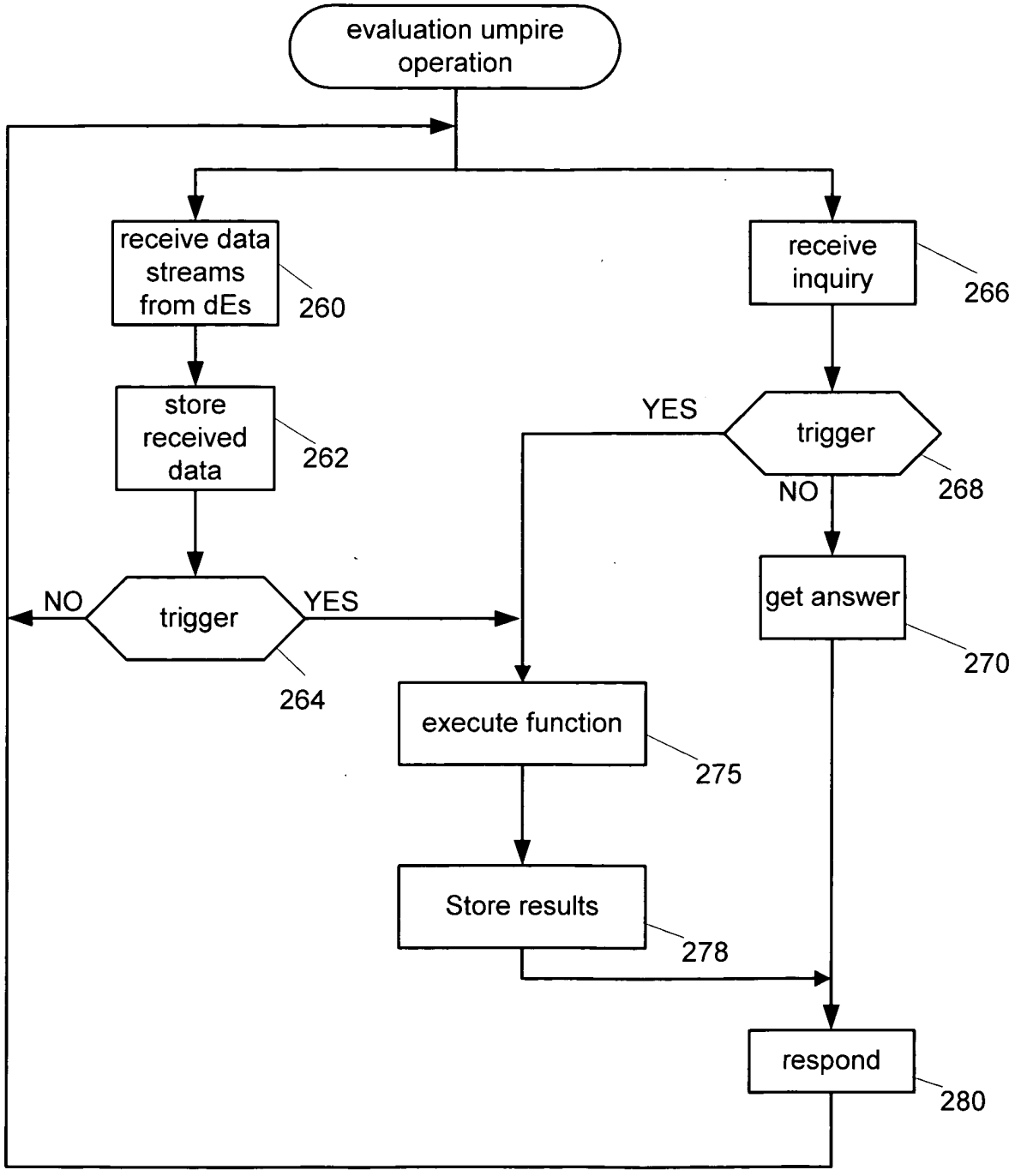

evaluation umpire operation
receive data streams from dEs
260
store received data
262
NO
trigger
YES
264
receive inquiry
266
YES
trigger
NO
268
get answer
270
execute function
275
Store results
278
respond
280

FIG. 6

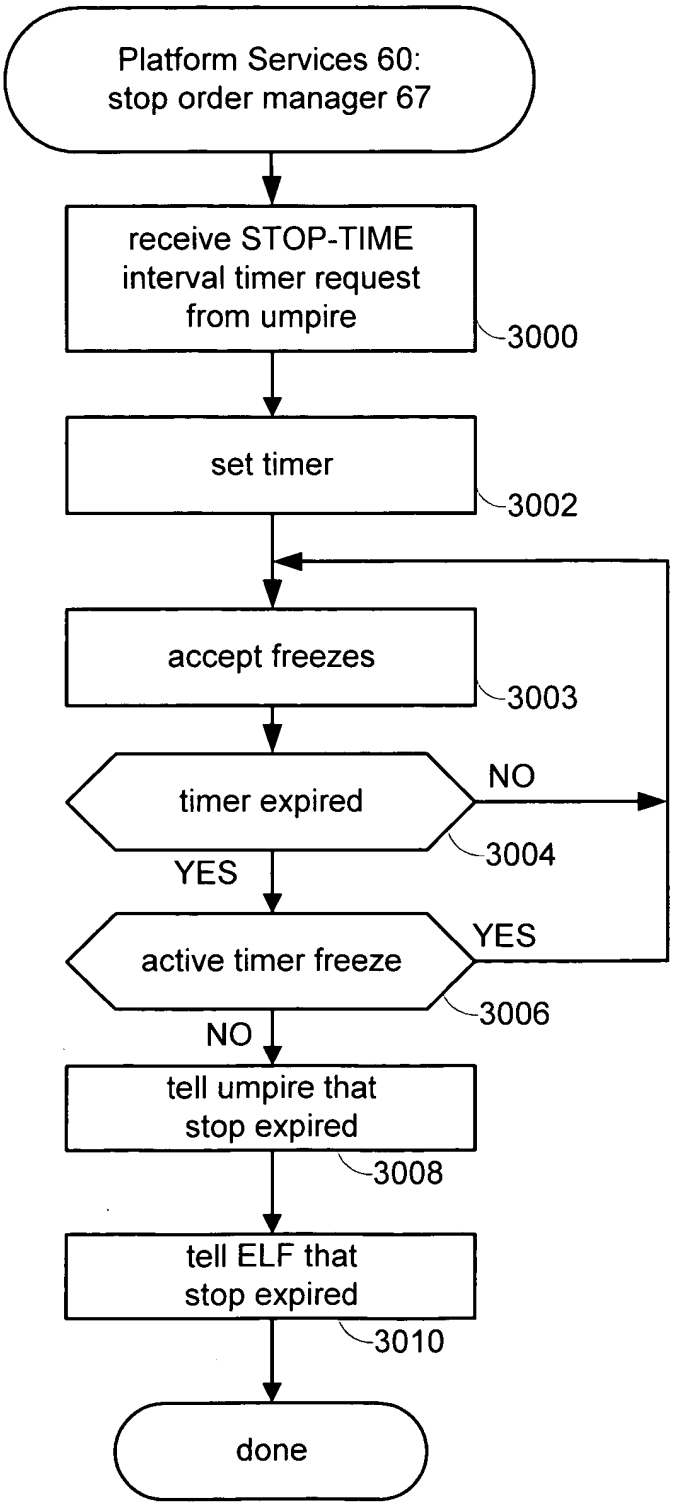

Platform Services 60:
stop order manager 67
receive STOP-TIME
interval timer request
from umpire
3000
set timer
3002
accept freezes
3003
timer expired
NO
3004
YES
active timer freeze
YES
3006
NO
tell umpire that
stop expired
3008
tell ELF that
stop expired
3010
done

FIG. 7

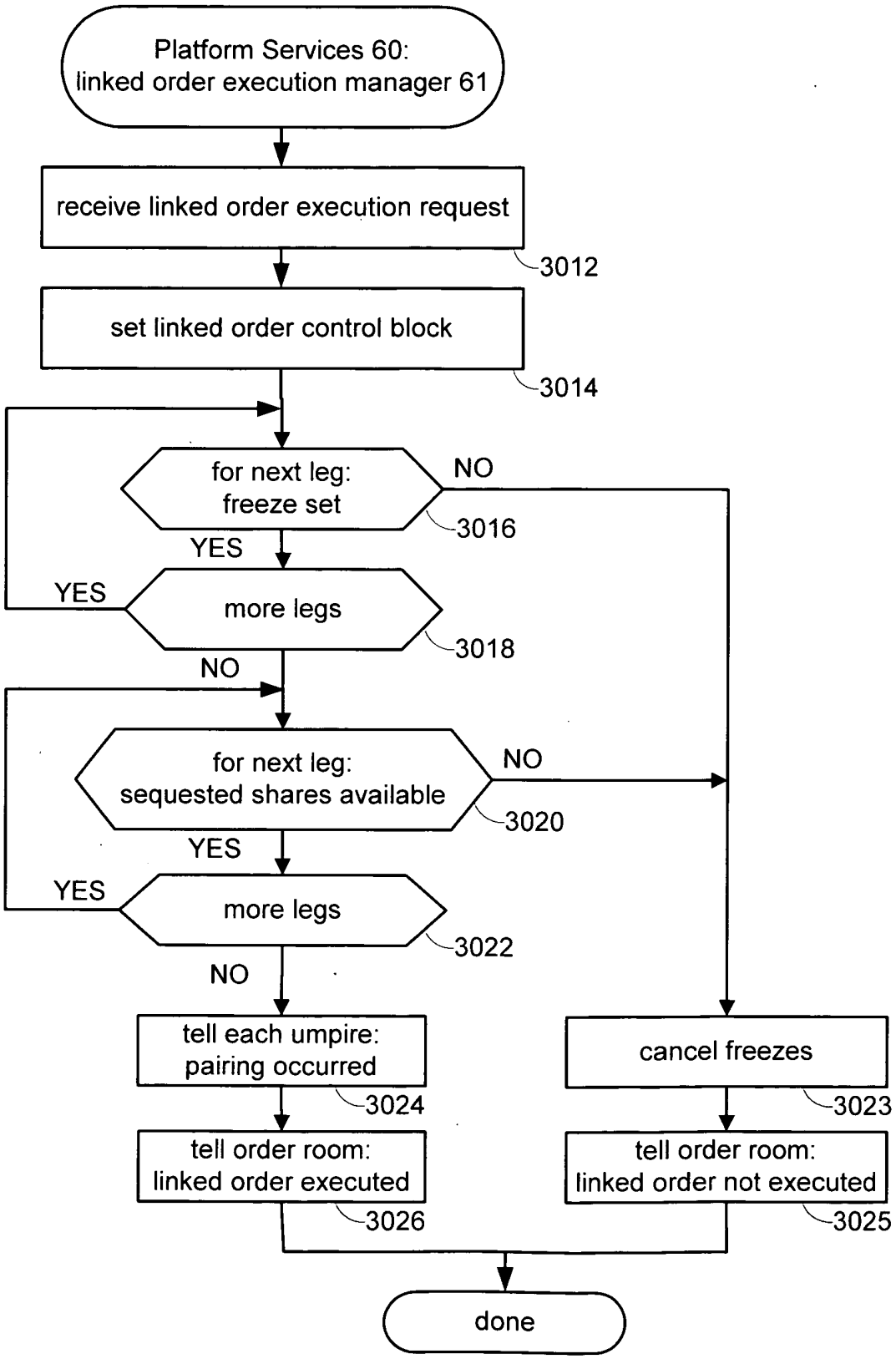

Platform Services 60:
linked order execution manager 61
receive linked order execution request
3012
set linked order control block
3014
for next leg:
freeze set
NO
3016
YES
YES
more legs
3018
NO
for next leg:
sequested shares available
NO
3020
YES
YES
more legs
3022
NO
tell each umpire:
pairing occurred
3024
tell order room:
linked order executed
3026
cancel freezes
3023
tell order room:
linked order not executed
3025
done

FIG. 8

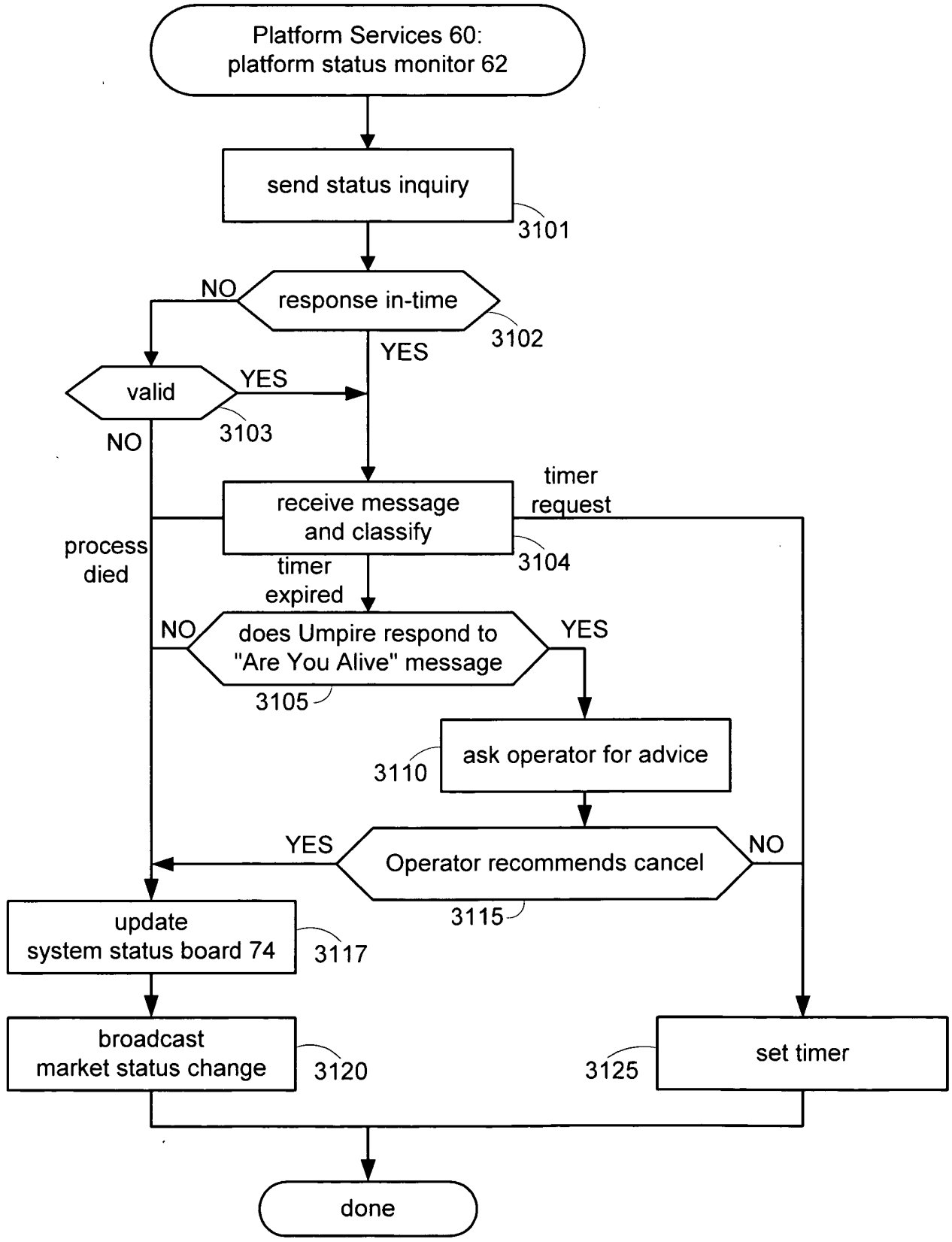

Platform Services 60:
platform status monitor 62
send status inquiry
3101
NO
response in-time
3102
YES
valid
YES
3103
NO
receive message
and classify
3104
timer
request
process
died
timer
expired
NO
does Umpire respond to
"Are You Alive" message
3105
YES
ask operator for advice
3110
YES
Operator recommends cancel
3115
NO
update
system status board 74
3117
broadcast
market status change
3120
set timer
3125
done

FIG. 9

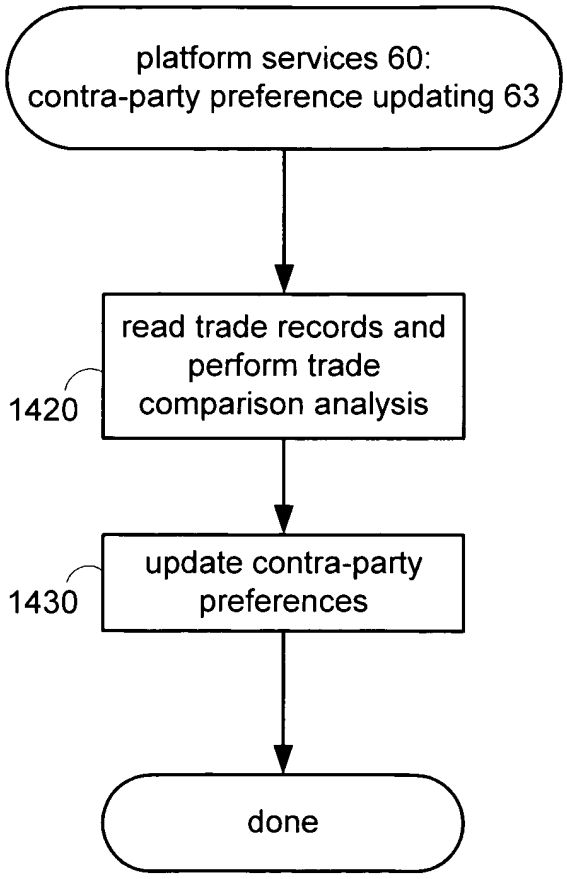

platform services 60:
contra-party preference updating 63
read trade records and perform trade comparison analysis
1420
update contra-party preferences
1430
done

FIG. 10

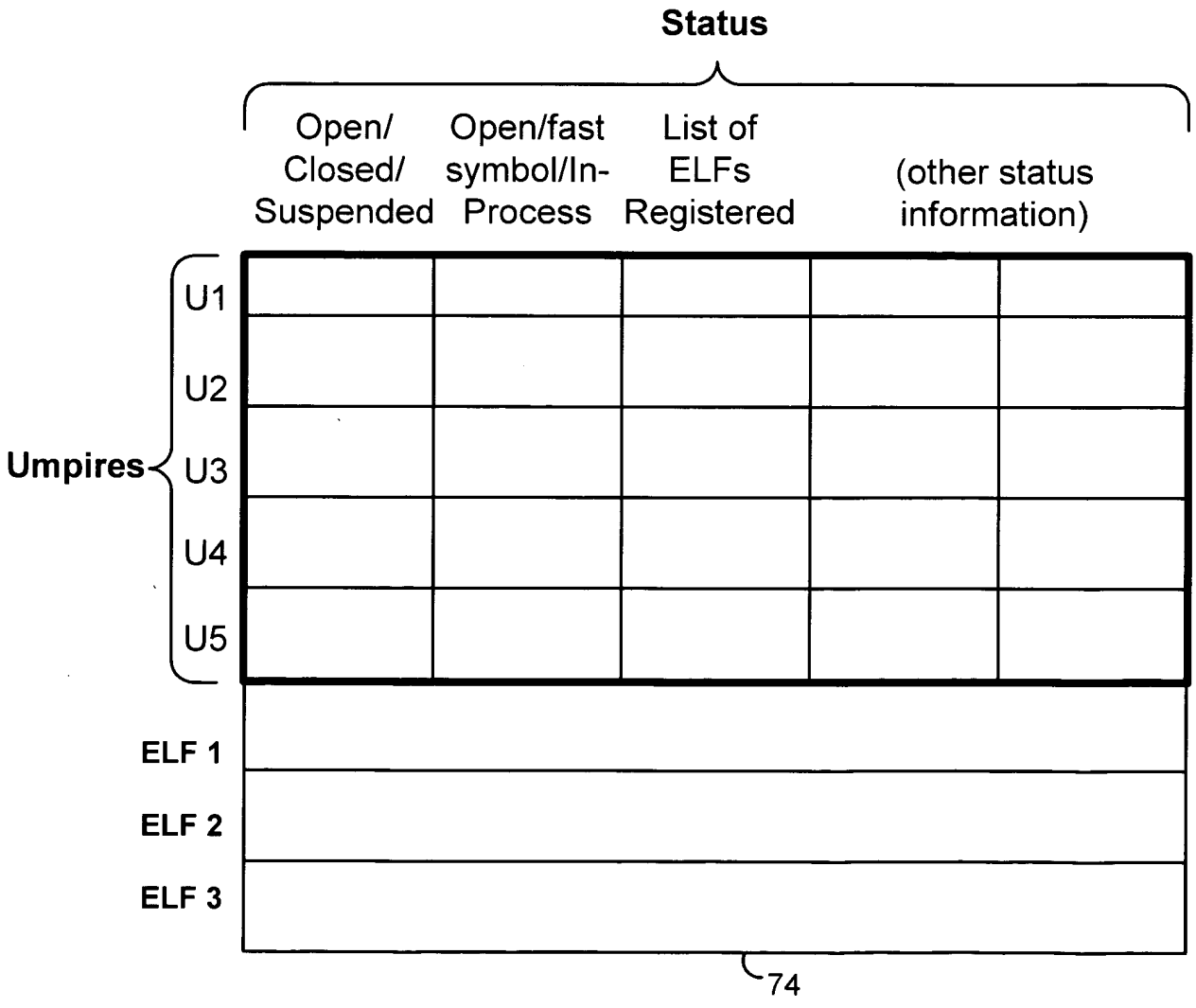

Status
Open/ Closed/ Suspended
Open/fast symbol/In-Process
List of ELFs Registered
(other status information)
Umpires
U1
U2
U3
U4
U5
ELF 1
ELF 2
ELF 3
74

FIG. 11

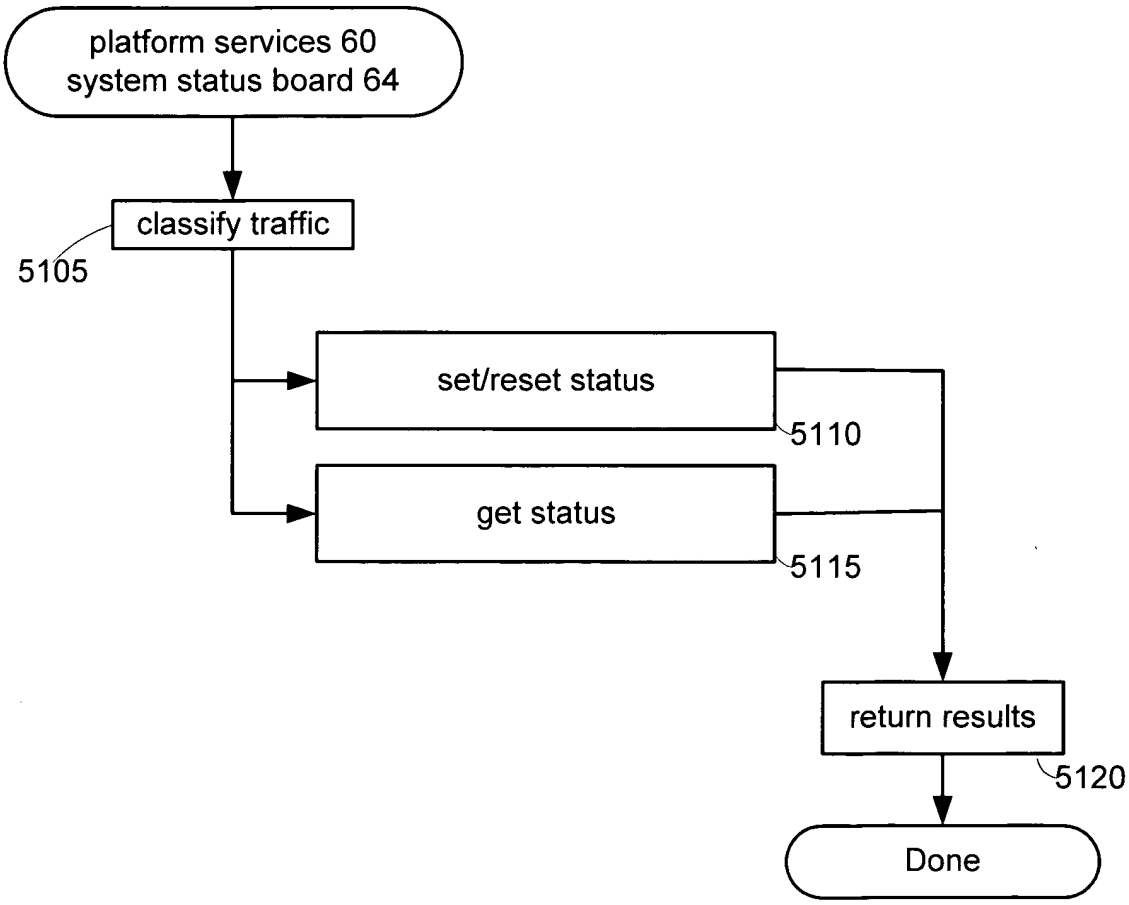

platform services 60
system status board 64
classify traffic
5105
set/reset status
5110
get status
5115
return results
5120
Done

FIG. 12

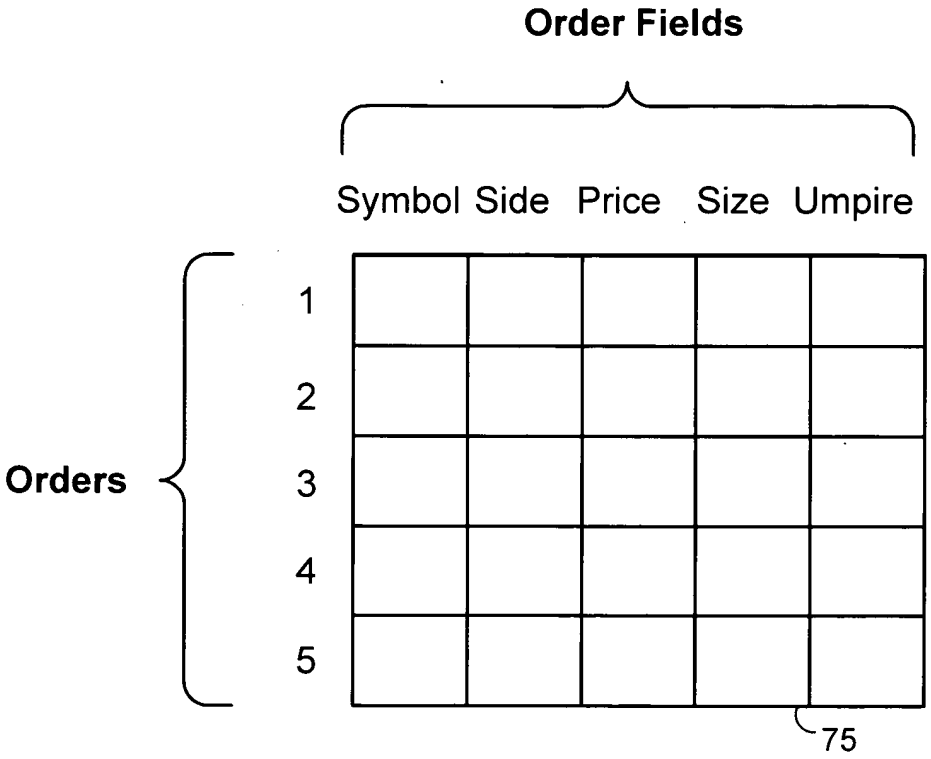


FIG. 13

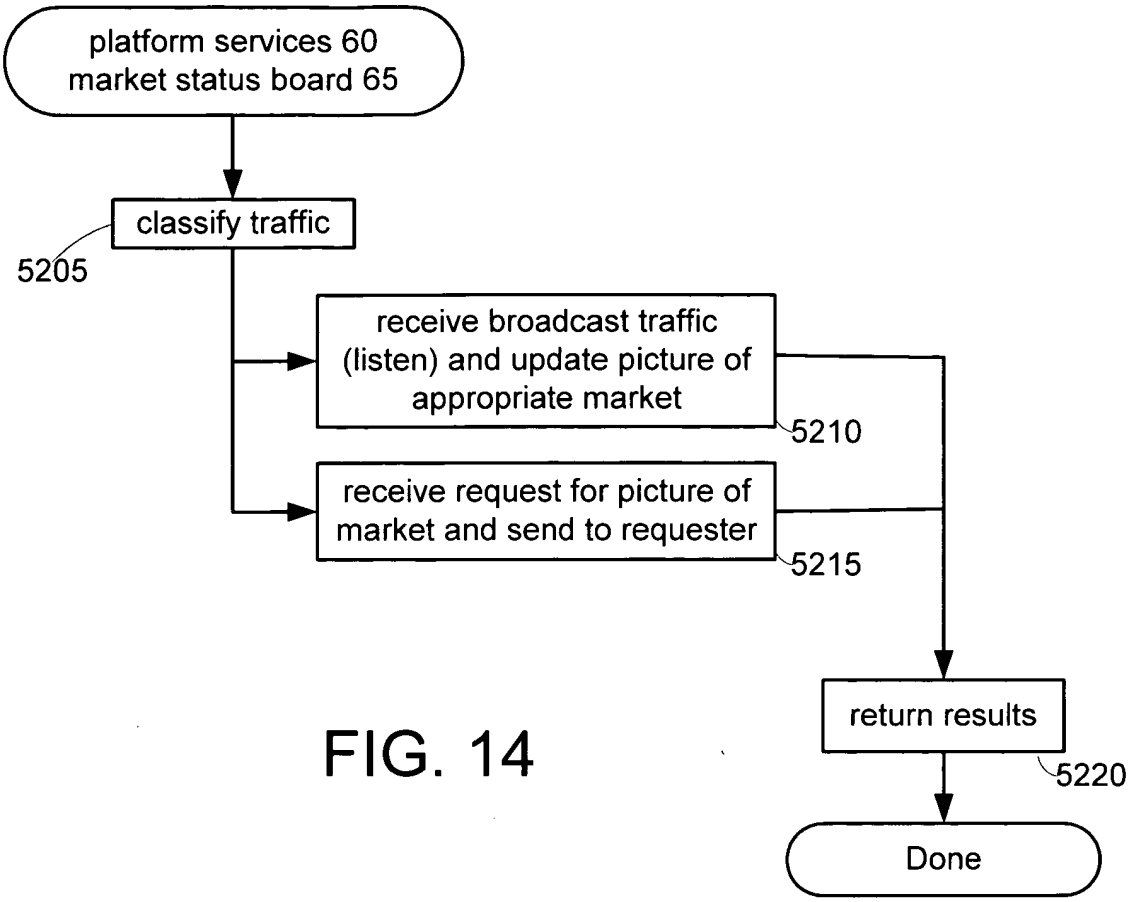

platform services 60
market status board 65
classify traffic
5205
receive broadcast traffic (listen) and update picture of appropriate market
5210
receive request for picture of market and send to requester
5215
return results
5220
Done

FIG. 14

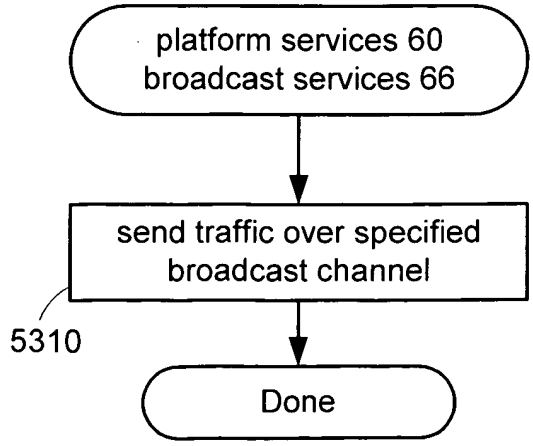

platform services 60
broadcast services 66
send traffic over specified broadcast channel
5310
Done

FIG. 15

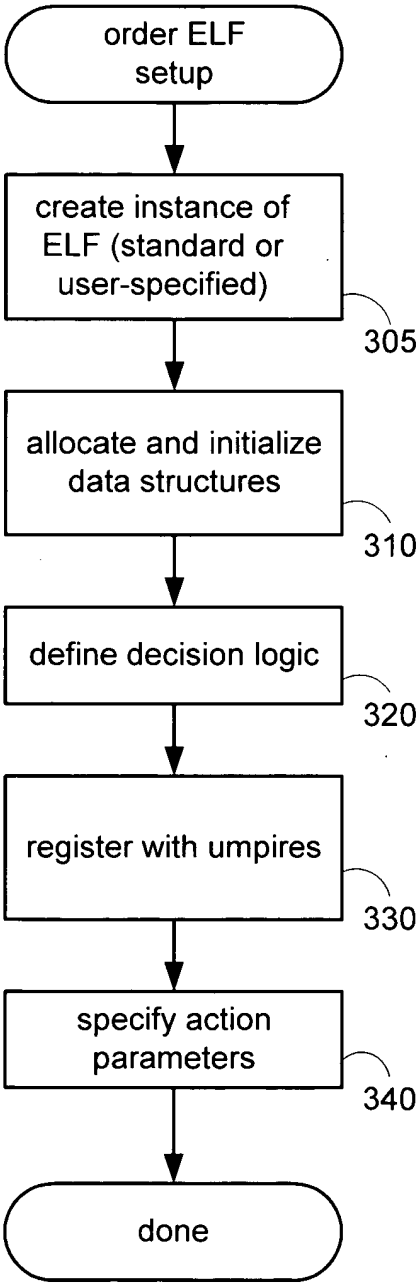

order ELF setup
create instance of ELF (standard or user-specified)
305
allocate and initialize data structures
310
define decision logic
320
register with umpires
330
specify action parameters
340
done

FIG. 16

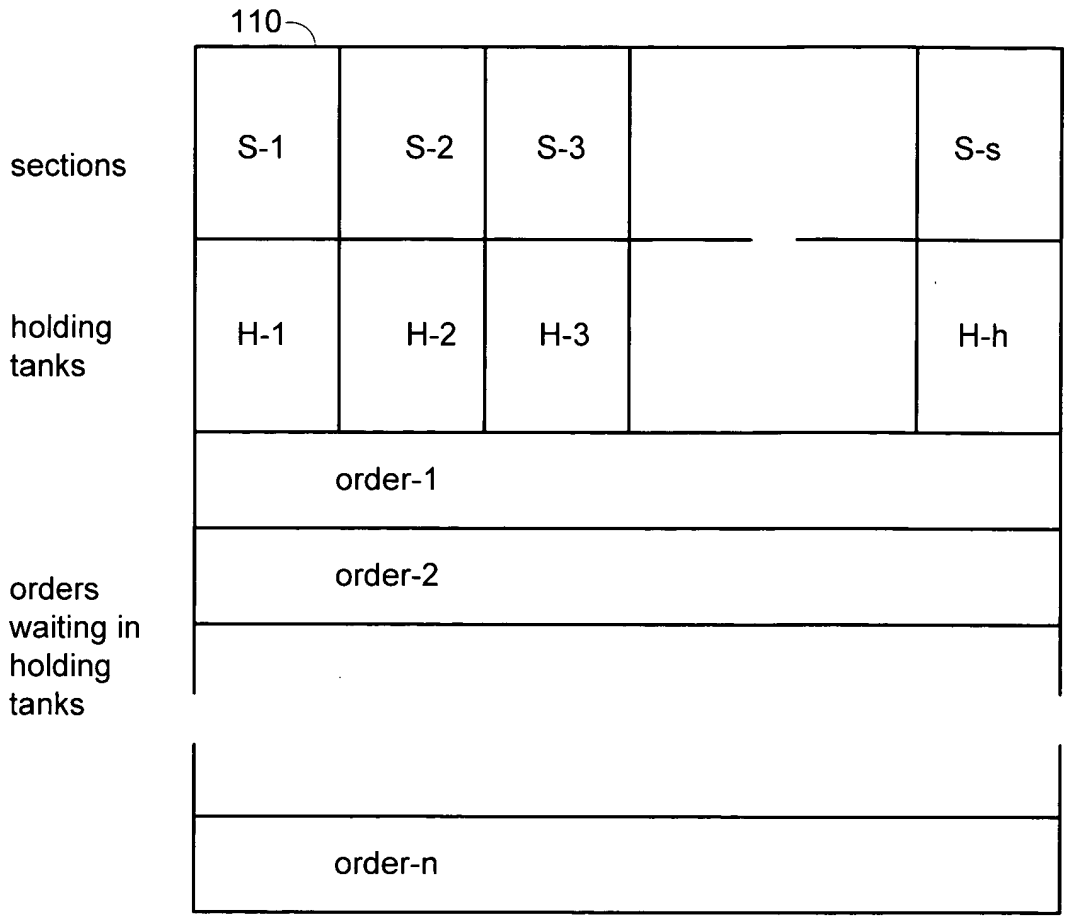

110
sections
S-1
S-2
S-3
S-s
holding tanks
H-1
H-2
H-3
H-h
order-1
order-2
orders waiting in holding tanks
order-n

FIG. 17

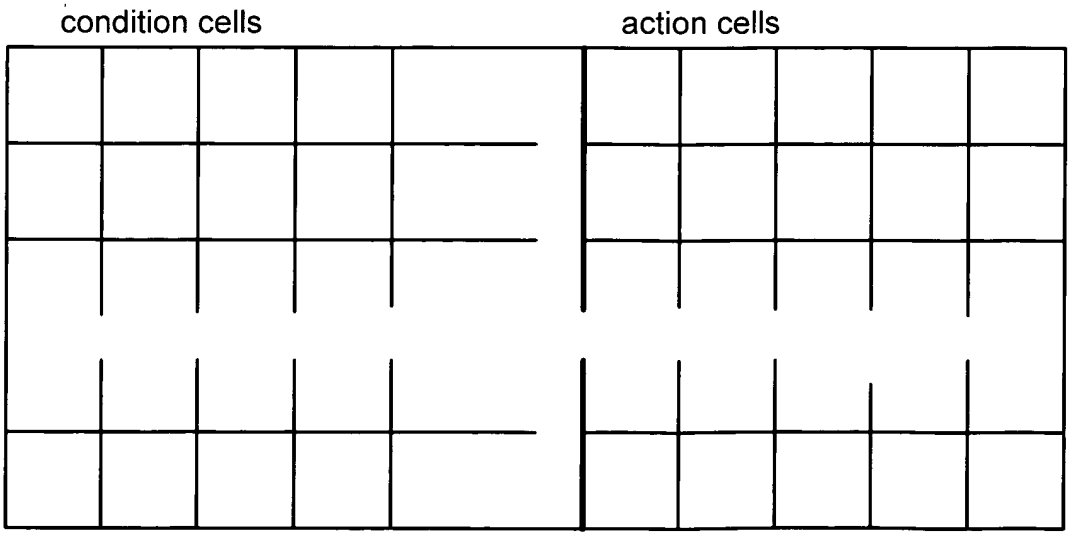

condition cells
action cells

FIG. 18

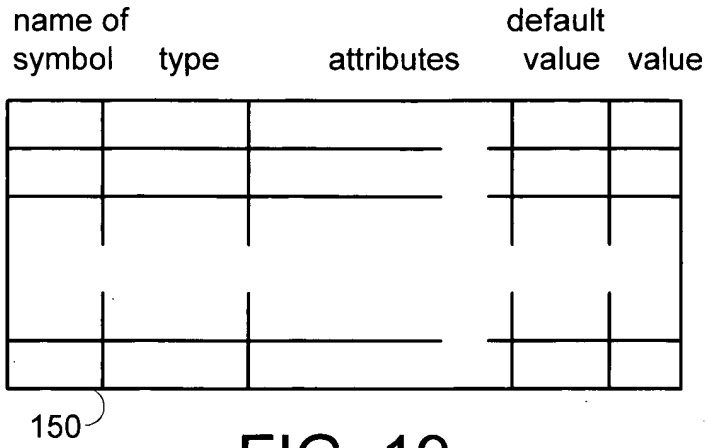

name of symbol
type
attributes
default value
value
150

FIG. 19

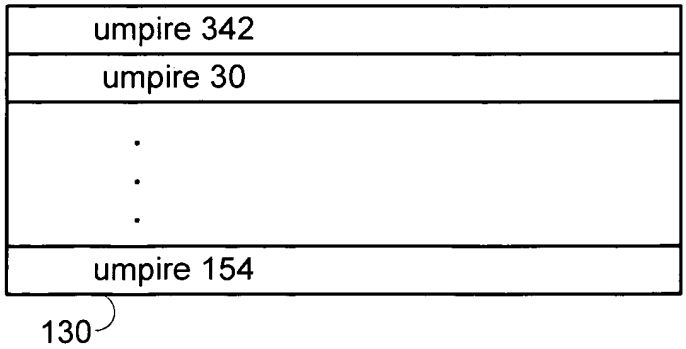

umpire 342
umpire 30
umpire 154
130

FIG. 20

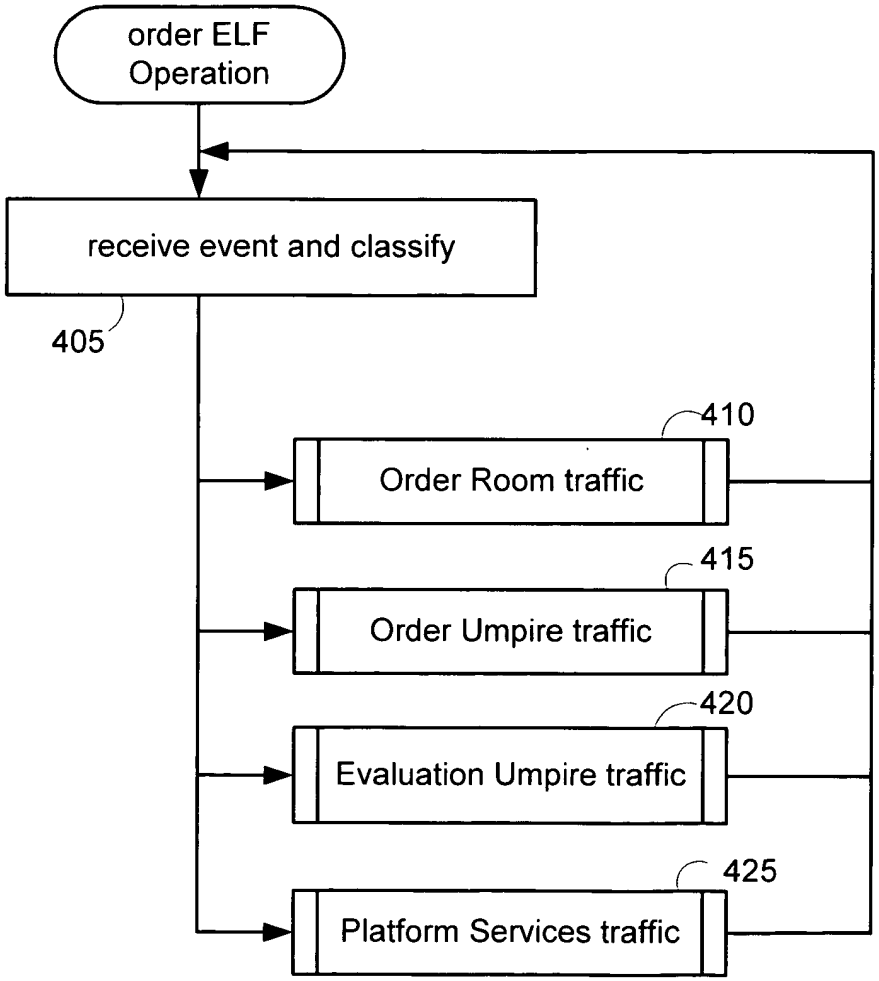

order ELF Operation
receive event and classify
405
410
Order Room traffic
415
Order Umpire traffic
420
Evaluation Umpire traffic
425
Platform Services traffic

FIG. 21

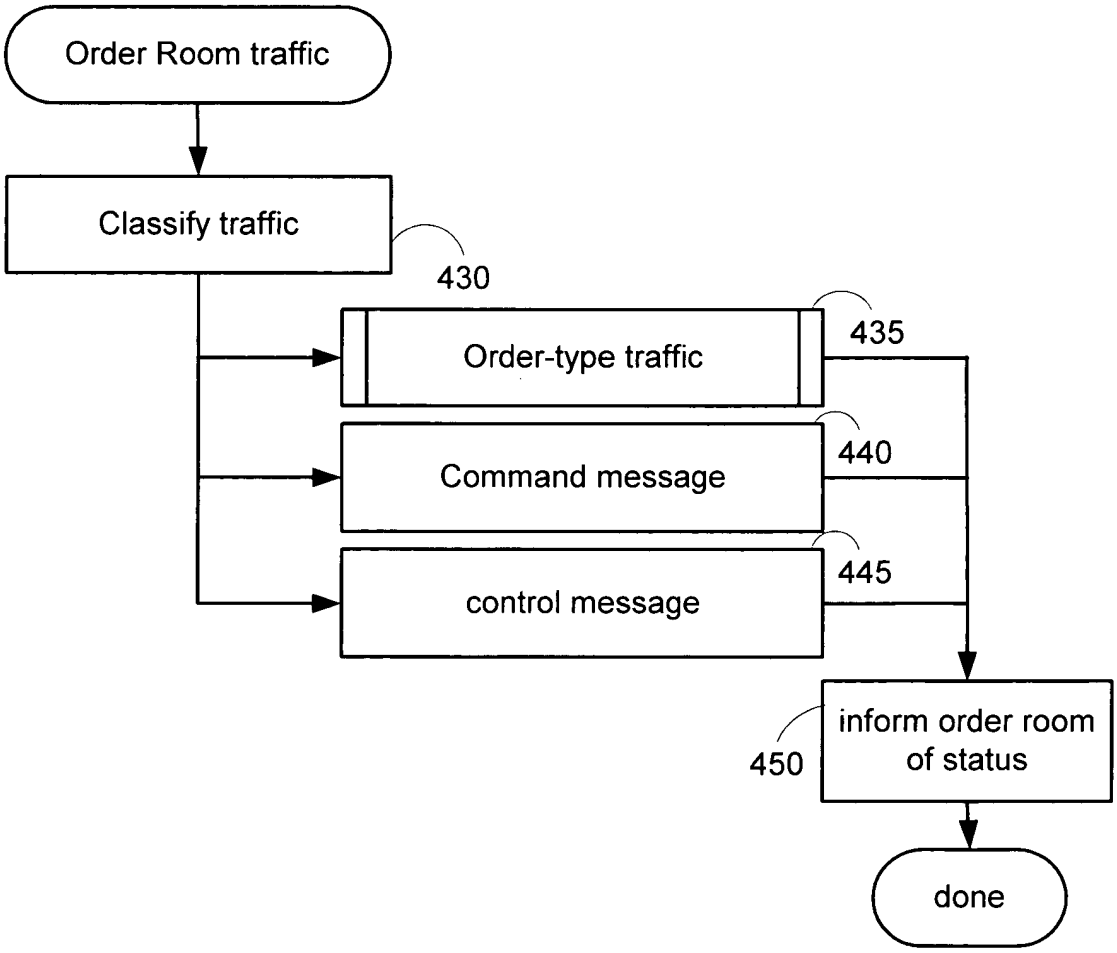

Order Room traffic
Classify traffic
430
Order-type traffic
435
Command message
440
control message
445
inform order room of status
450
done

FIG. 22

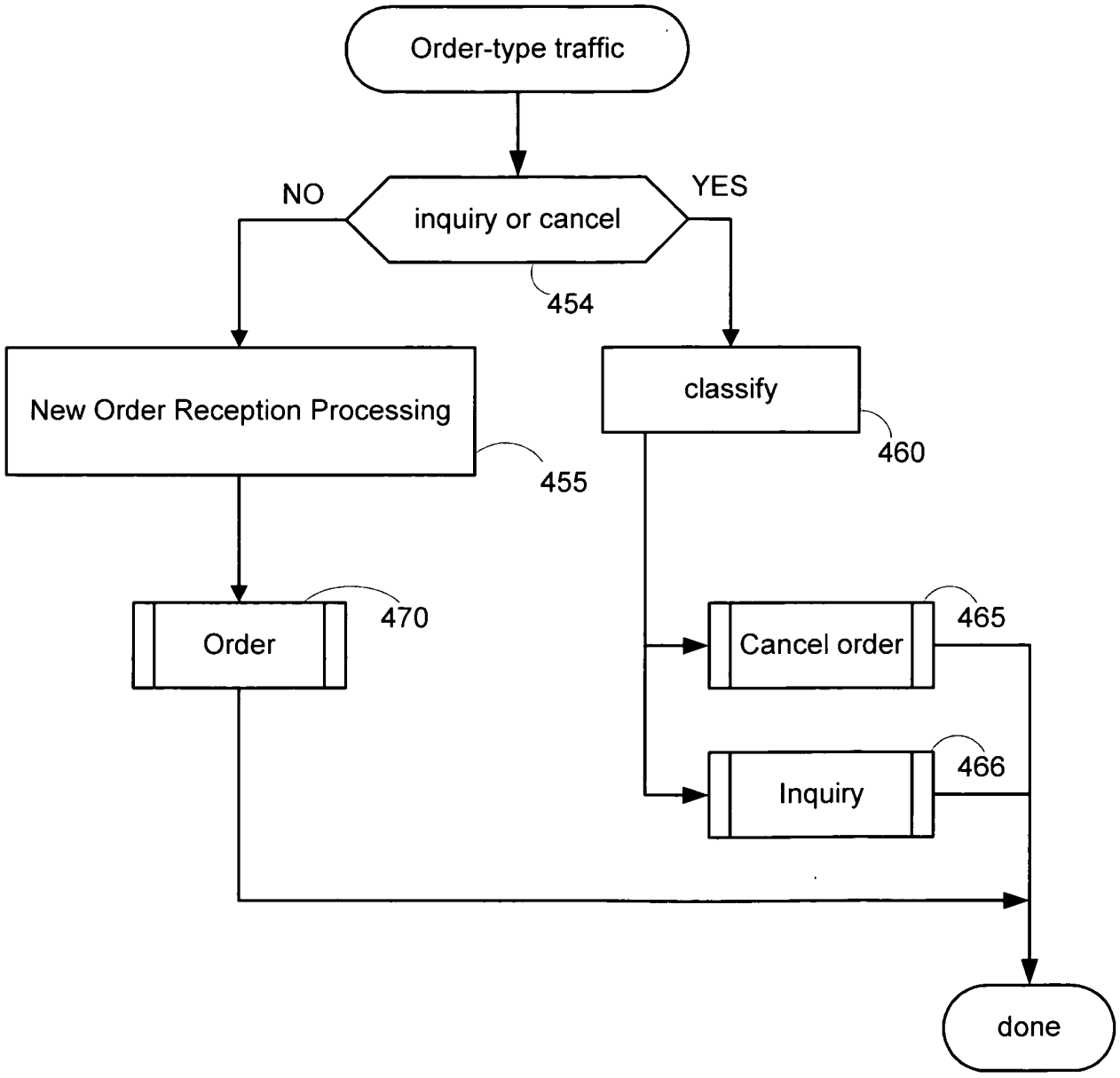

Order-type traffic
NO
inquiry or cancel
YES
454
New Order Reception Processing
455
classify
460
Order
470
Cancel order
465
Inquiry
466
done

FIG. 23

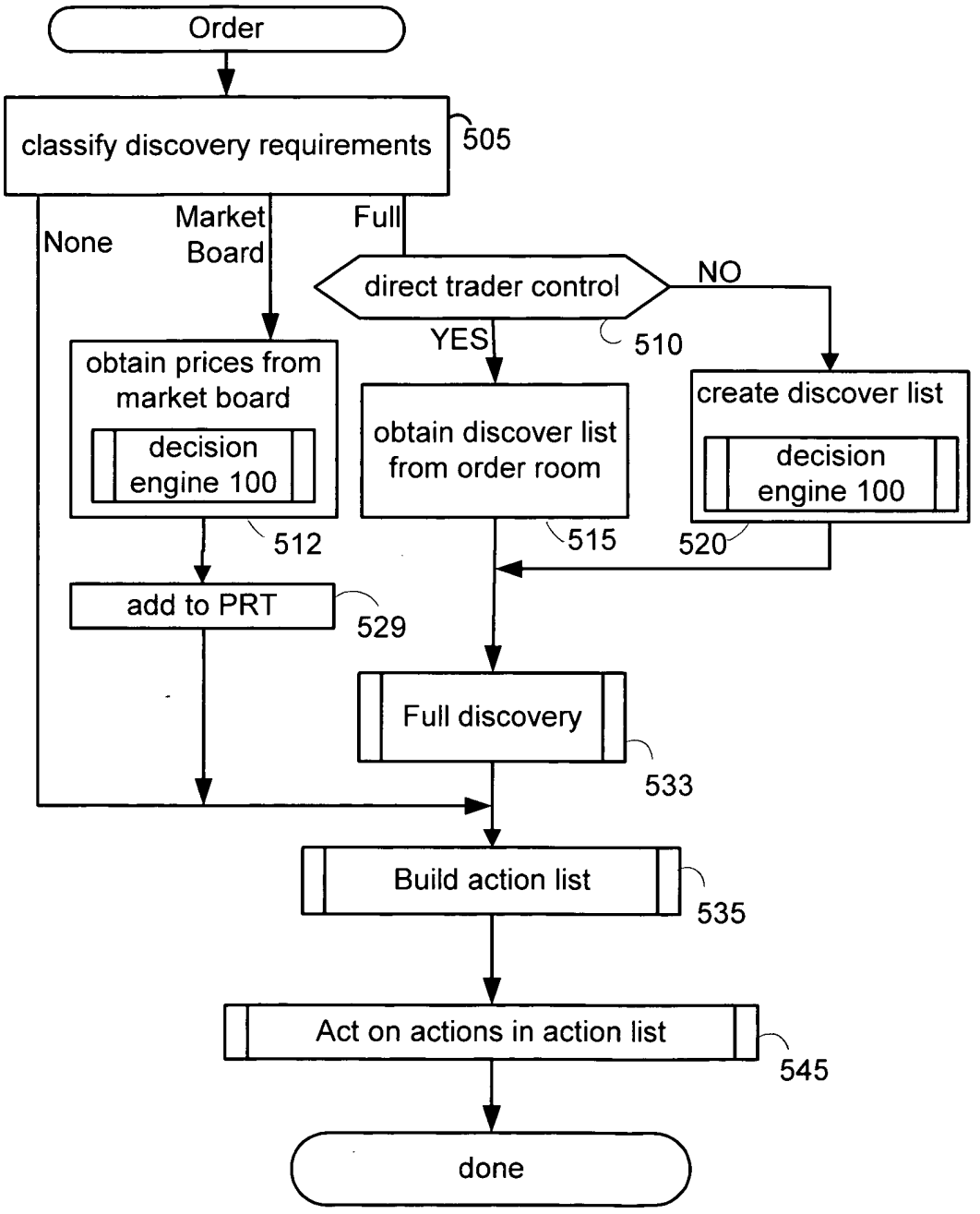

Order
classify discovery requirements
505
None
Market Board
Full
direct trader control
NO
YES
510
obtain prices from market board
decision engine 100
512
obtain discover list from order room
515
create discover list
decision engine 100
520
add to PRT
529
Full discovery
533
Build action list
535
Act on actions in action list
545
done

FIG. 24

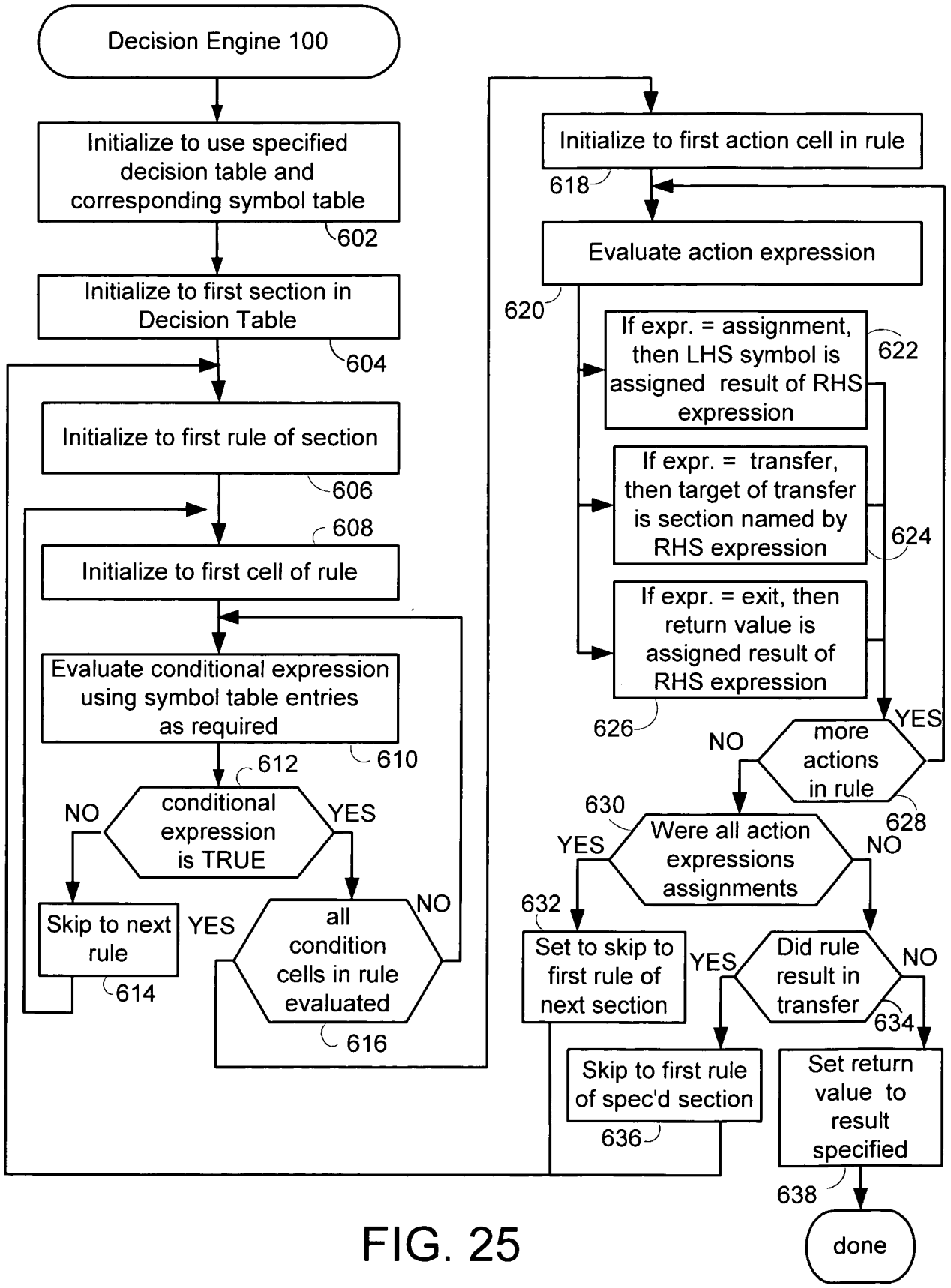

Decision Engine 100
Initialize to use specified decision table and corresponding symbol table
602
Initialize to first section in Decision Table
604
Initialize to first rule of section
606
608
Initialize to first cell of rule
Evaluate conditional expression using symbol table entries as required
610
612
conditional expression is TRUE
NO
YES
Skip to next rule
614
YES
all condition cells in rule evaluated
NO
616
Initialize to first action cell in rule
618
Evaluate action expression
620
If expr. = assignment, then LHS symbol is assigned result of RHS expression
622
If expr. = transfer, then target of transfer is section named by RHS expression
624
If expr. = exit, then return value is assigned result of RHS expression
626
more actions in rule
YES
NO
628
630
Were all action expressions assignments
YES
NO
632
Set to skip to first rule of next section
Did rule result in transfer
YES
NO
634
Skip to first rule of spec'd section
636
Set return value to result specified
638
done

FIG. 25

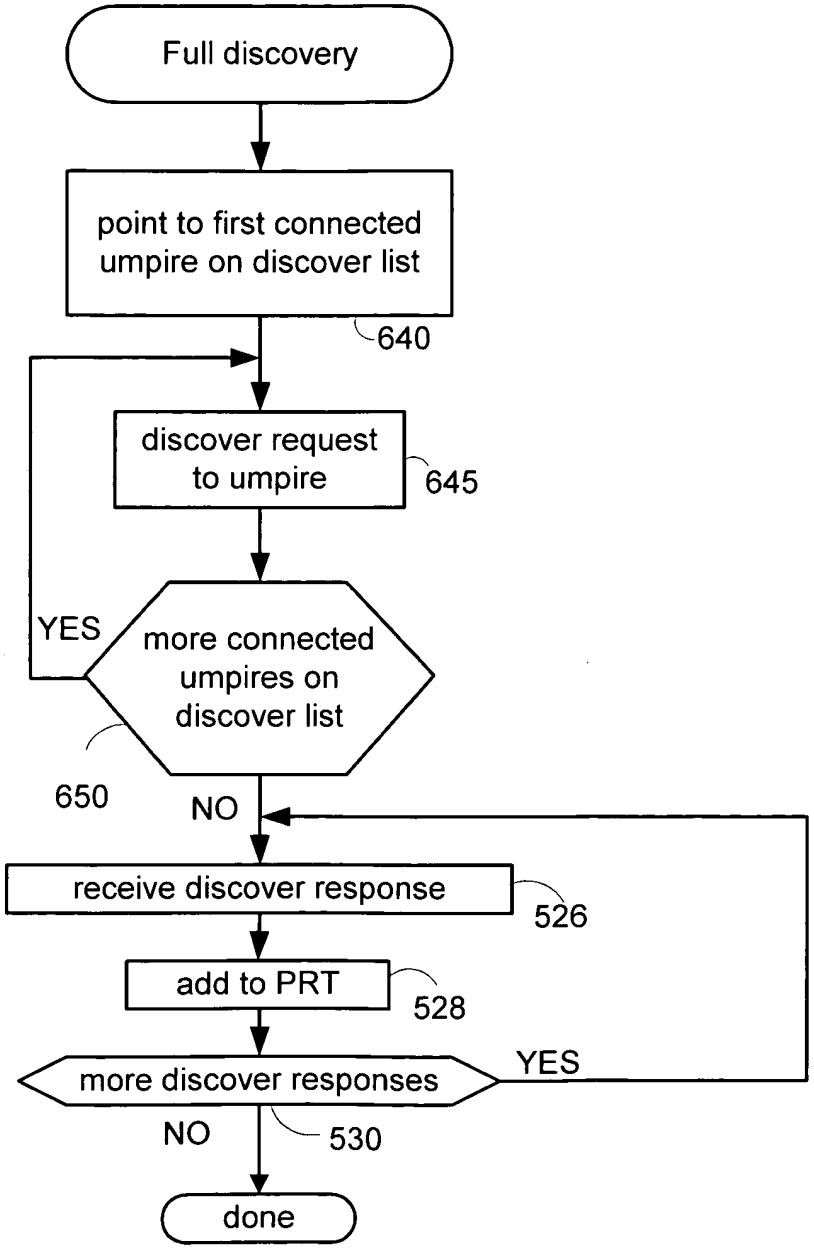

Full discovery
point to first connected umpire on discover list
640
discover request to umpire
645
YES
more connected umpires on discover list
650
NO
receive discover response
526
add to PRT
528
more discover responses
YES
NO
530
done

FIG. 26

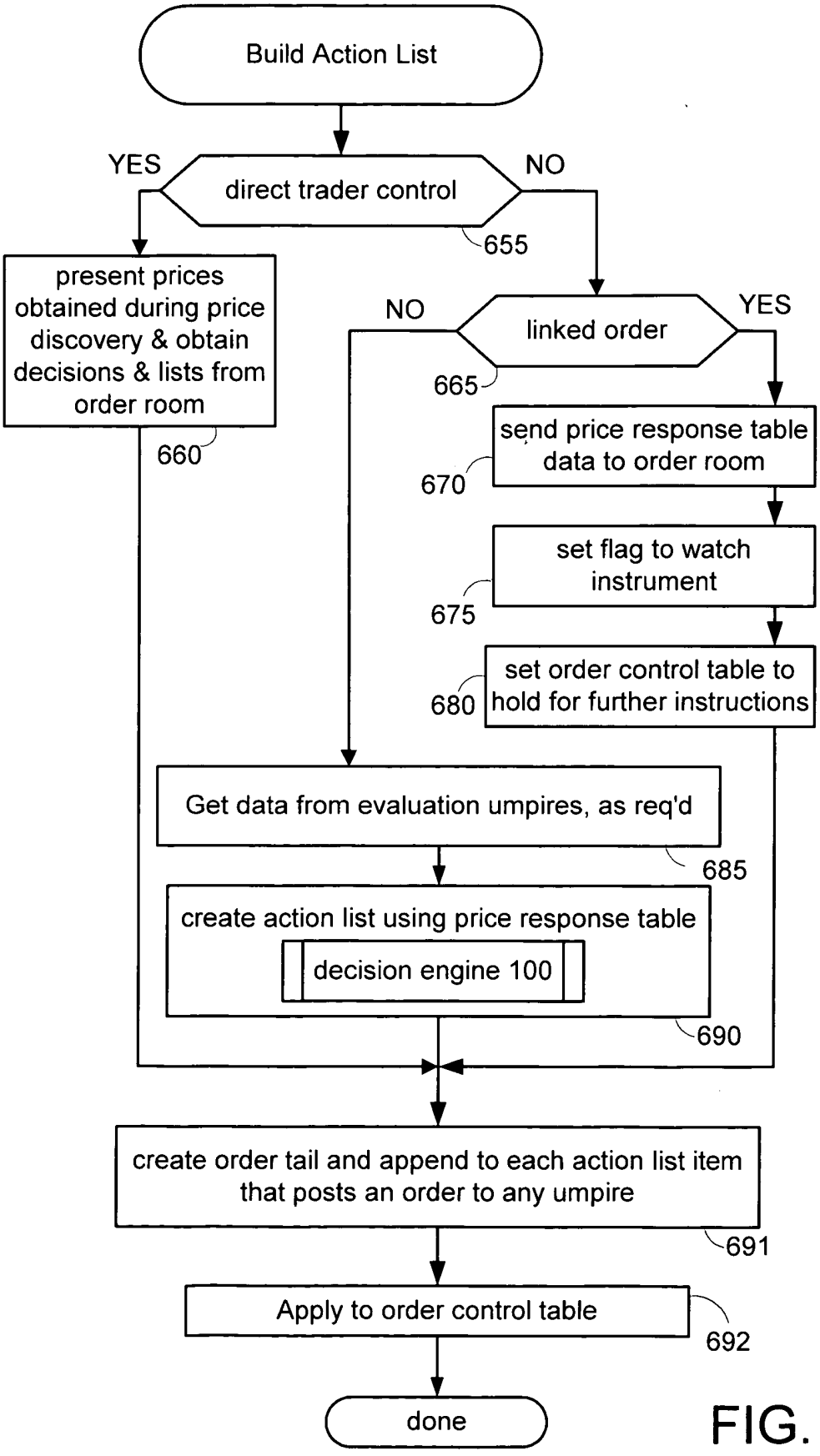

Build Action List
YES
direct trader control
NO
655
present prices obtained during price discovery & obtain decisions & lists from order room
660
NO
linked order
YES
665
send price response table data to order room
670
set flag to watch instrument
675
set order control table to hold for further instructions
680
Get data from evaluation umpires, as req'd
685
create action list using price response table
decision engine 100
690
create order tail and append to each action list item that posts an order to any umpire
691
Apply to order control table
692
done

FIG. 27

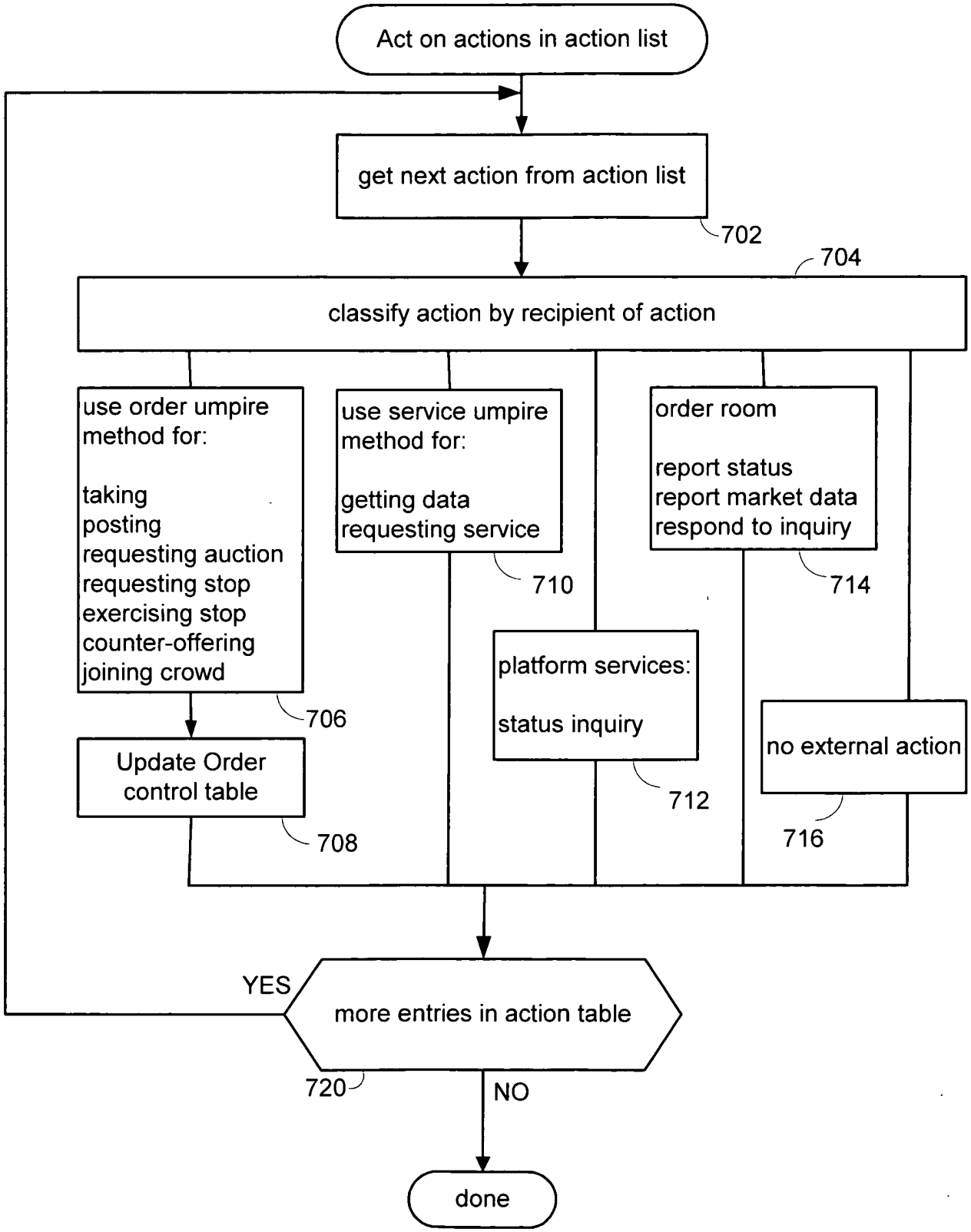

Act on actions in action list
get next action from action list
702
704
classify action by recipient of action
use order umpire method for:
taking
posting
requesting auction
requesting stop
exercising stop
counter-offering
joining crowd
706
Update Order control table
708
use service umpire method for:
getting data
requesting service
710
platform services:
status inquiry
712
order room
report status
report market data
respond to inquiry
714
no external action
716
YES
more entries in action table
720
NO
done

FIG. 28

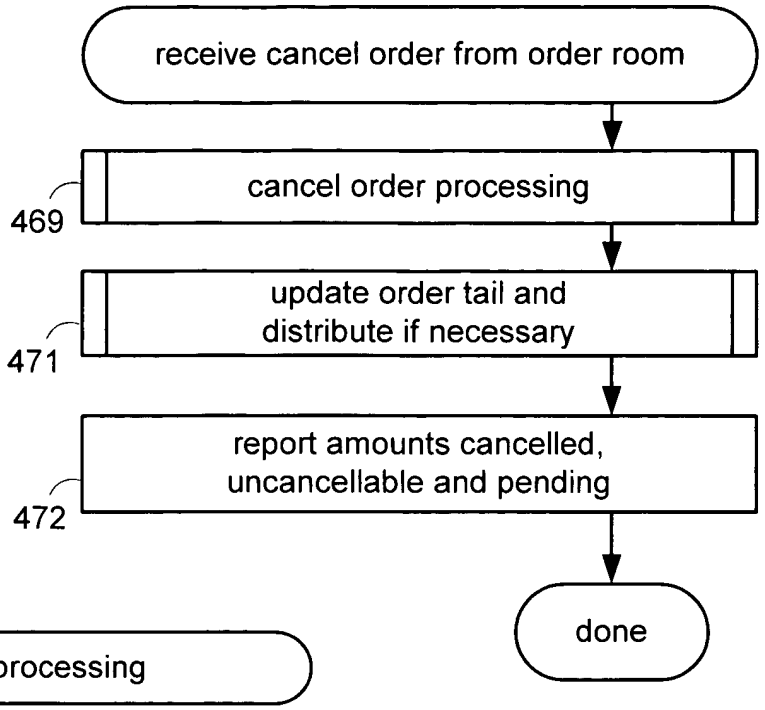


FIG. 29A

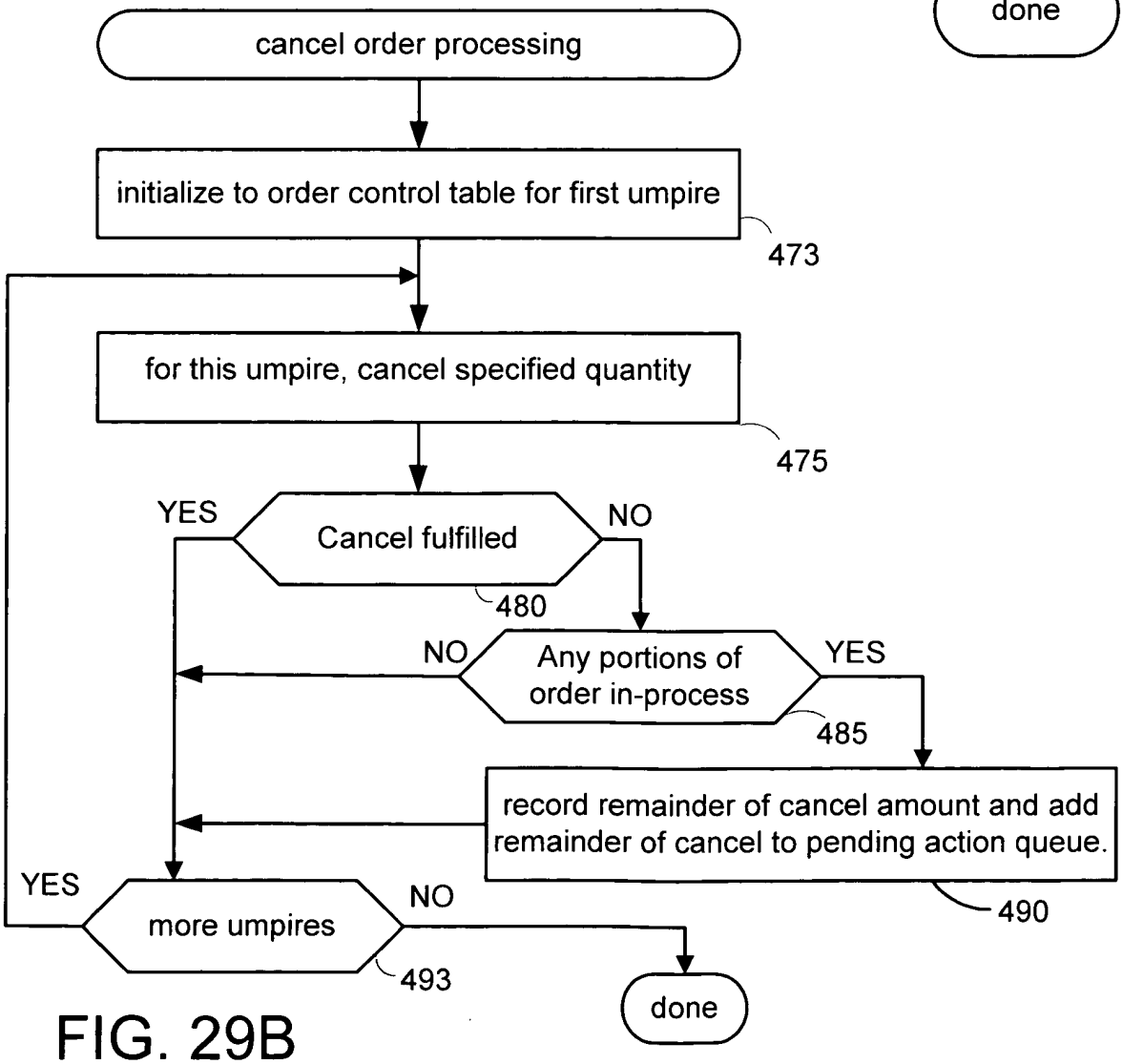


FIG. 29B

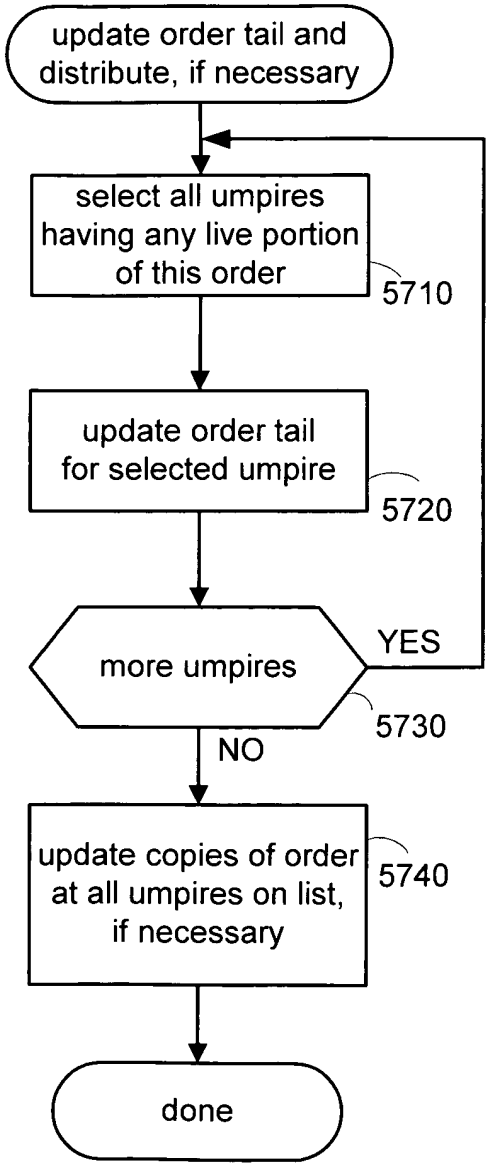

update order tail and distribute, if necessary
select all umpires having any live portion of this order
5710
update order tail for selected umpire
5720
more umpires
YES
5730
NO
update copies of order at all umpires on list, if necessary
5740
done

FIG. 30

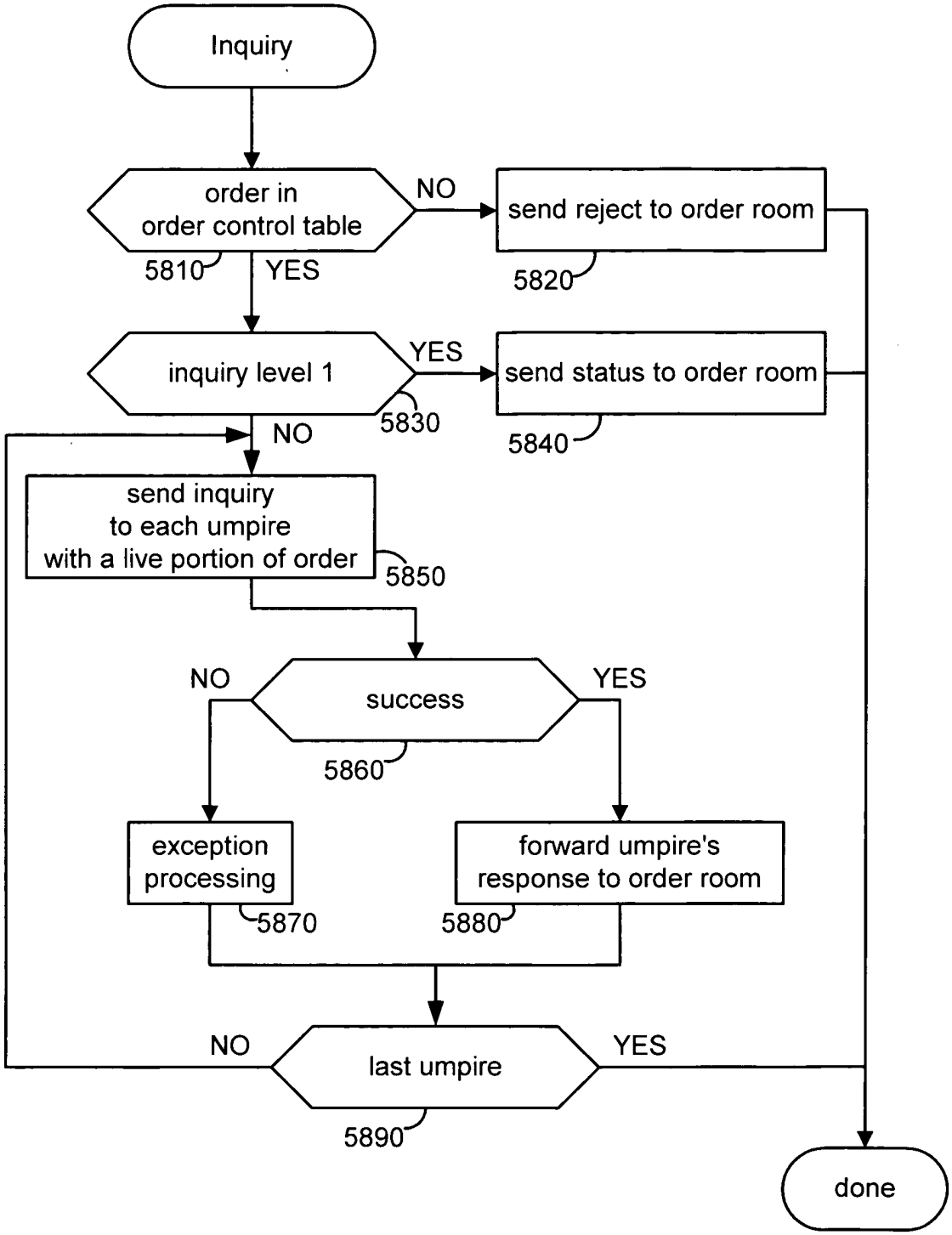

Inquiry
order in order control table
NO
send reject to order room
5810
YES
5820
inquiry level 1
YES
send status to order room
5830
NO
5840
send inquiry to each umpire with a live portion of order
5850
NO
success
YES
5860
exception processing
forward umpire's response to order room
5870
5880
NO
last umpire
YES
5890
done

FIG. 31

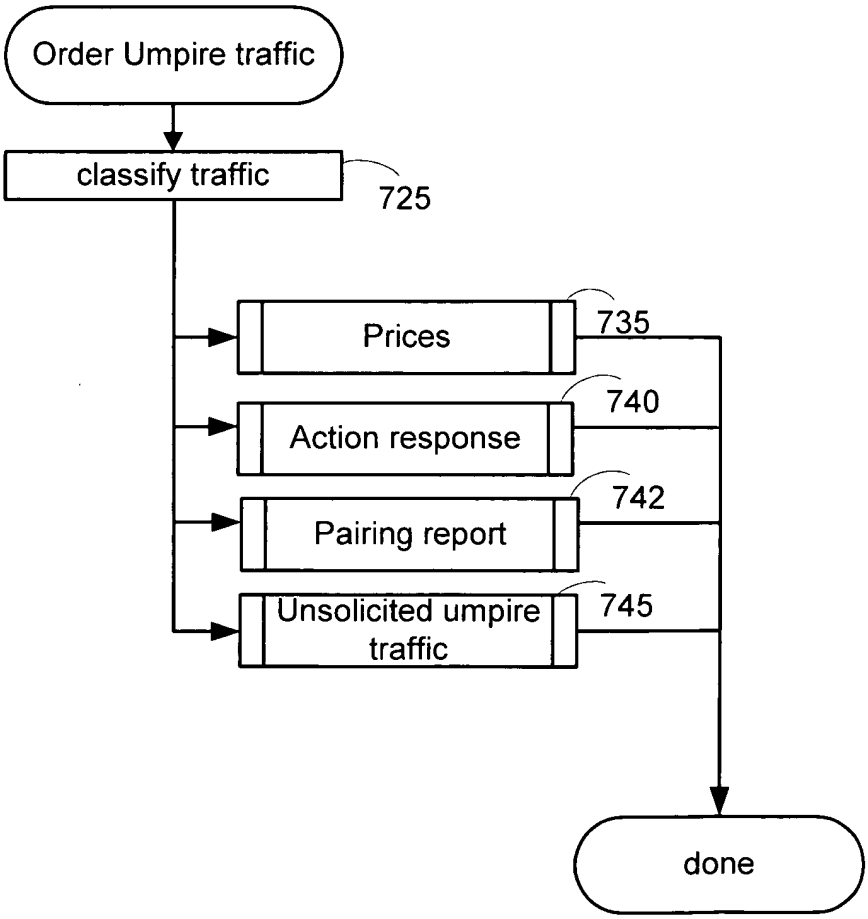

Order Umpire traffic
classify traffic
725
Prices
735
Action response
740
Pairing report
742
Unsolicited umpire traffic
745
done

FIG. 32

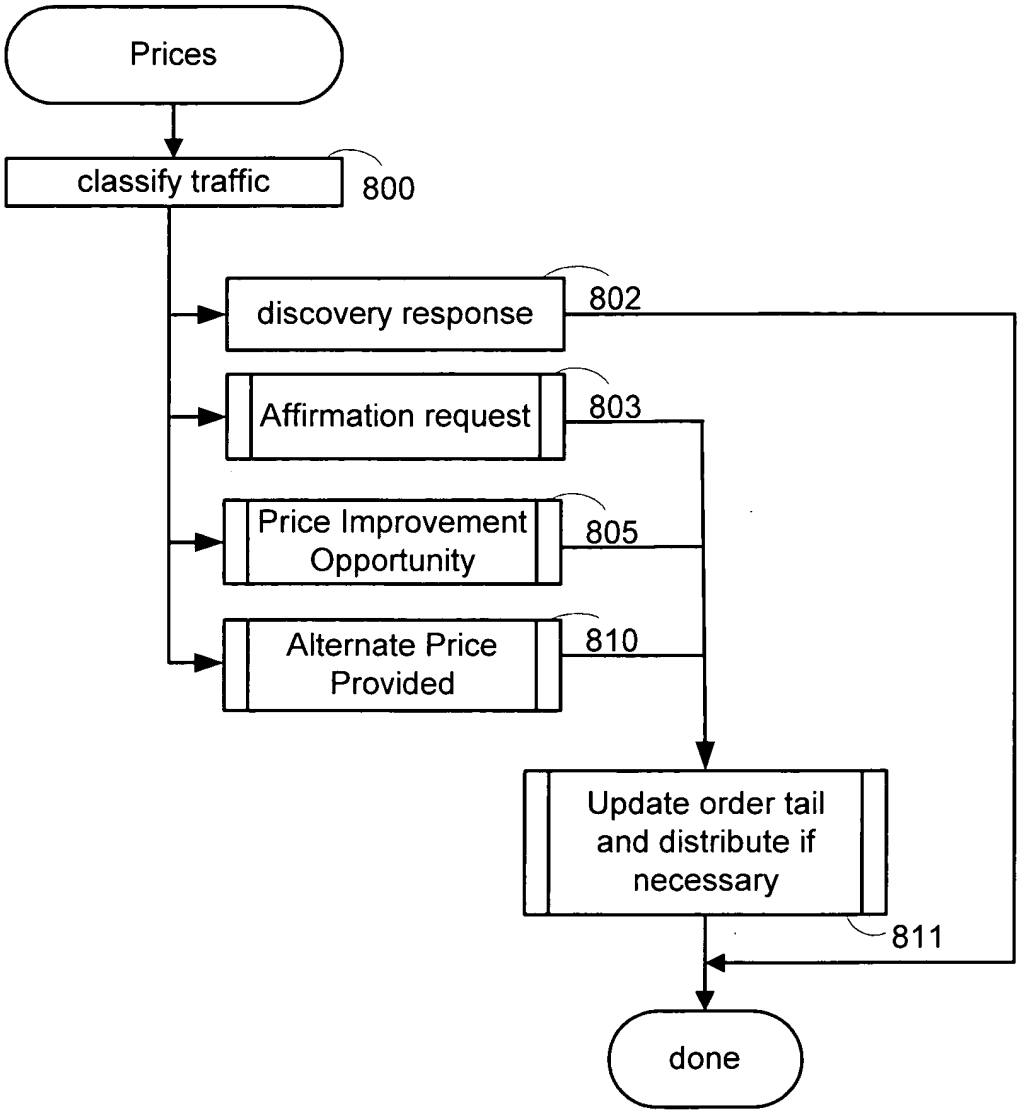

Prices
classify traffic
800
discovery response
802
Affirmation request
803
Price Improvement Opportunity
805
Alternate Price Provided
810
Update order tail and distribute if necessary
811
done

FIG. 33

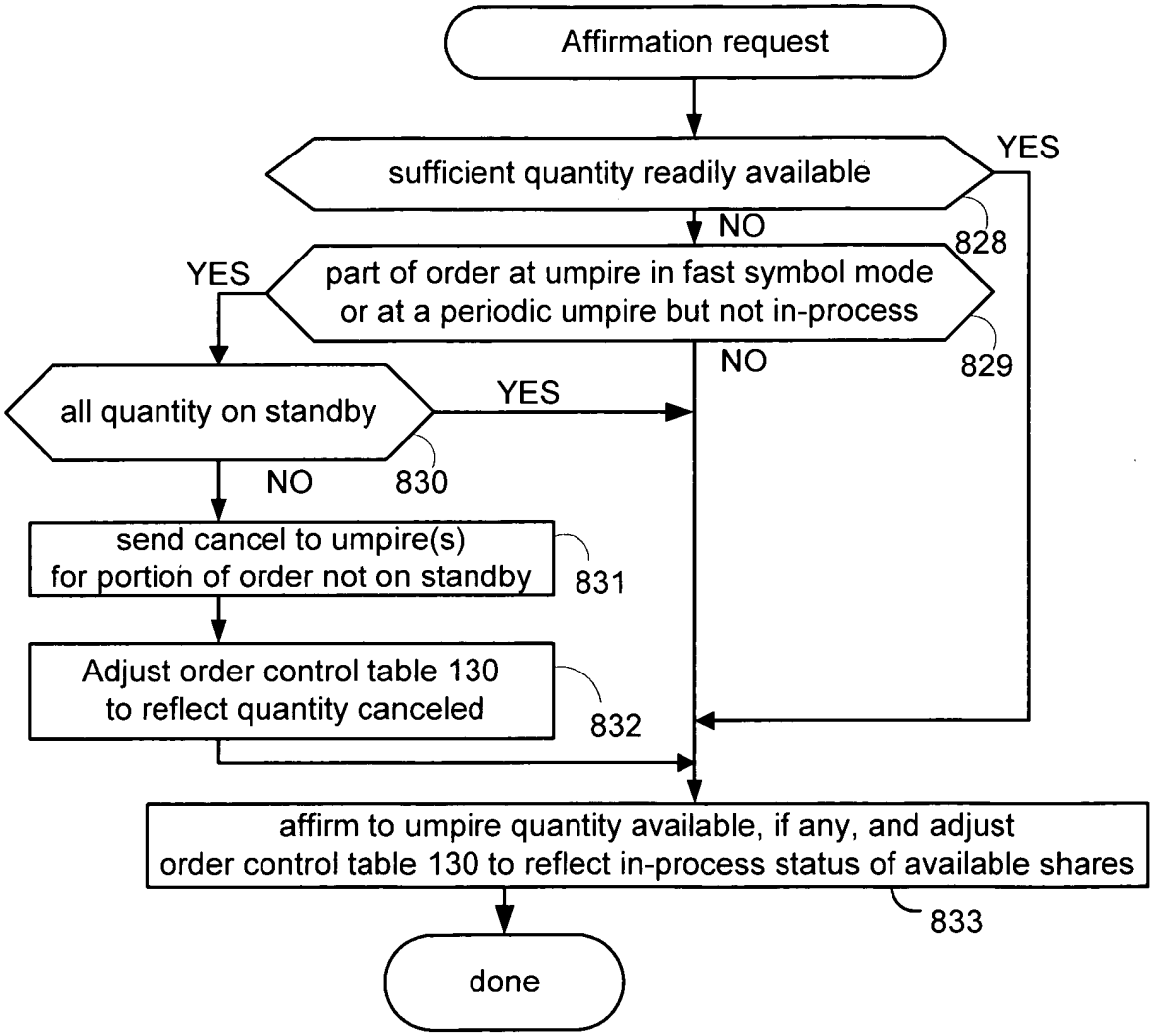

Affirmation request
sufficient quantity readily available
YES
828
NO
part of order at umpire in fast symbol mode or at a periodic umpire but not in-process
YES
829
NO
all quantity on standby
YES
830
NO
send cancel to umpire(s) for portion of order not on standby
831
Adjust order control table 130 to reflect quantity canceled
832
affirm to umpire quantity available, if any, and adjust order control table 130 to reflect in-process status of available shares
833
done

FIG. 34

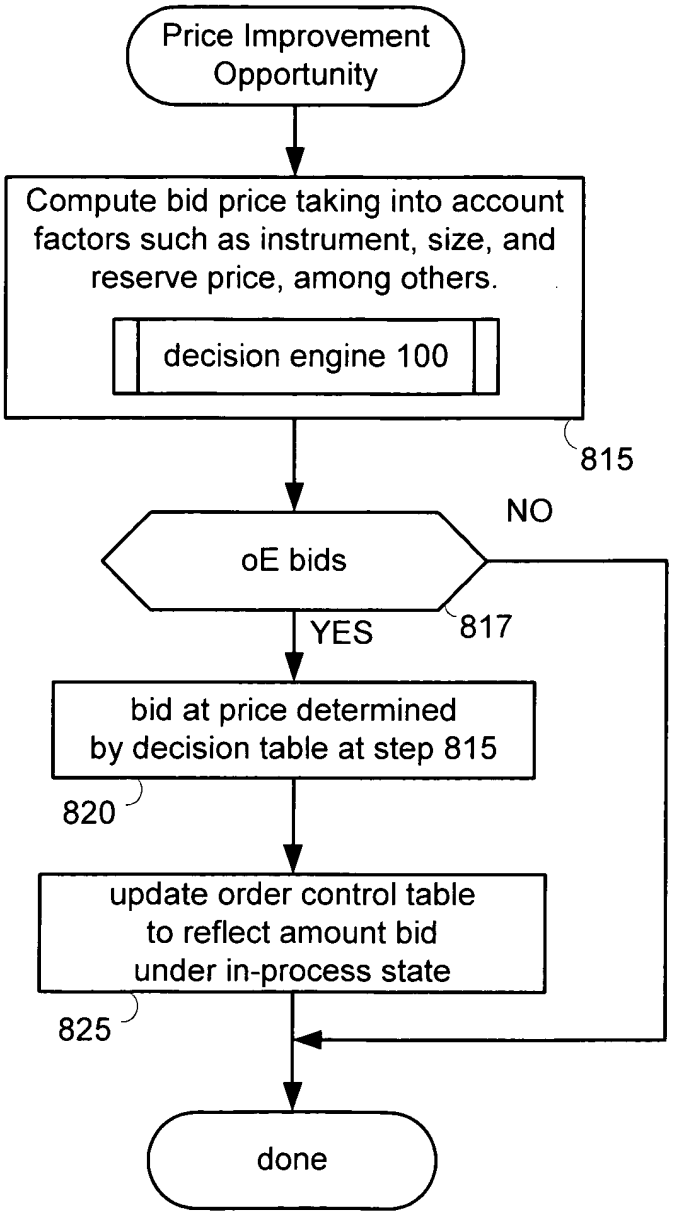

Price Improvement Opportunity
Compute bid price taking into account factors such as instrument, size, and reserve price, among others.
decision engine 100
815
NO
oE bids
817
YES
bid at price determined by decision table at step 815
820
update order control table to reflect amount bid under in-process state
825
done

FIG. 35

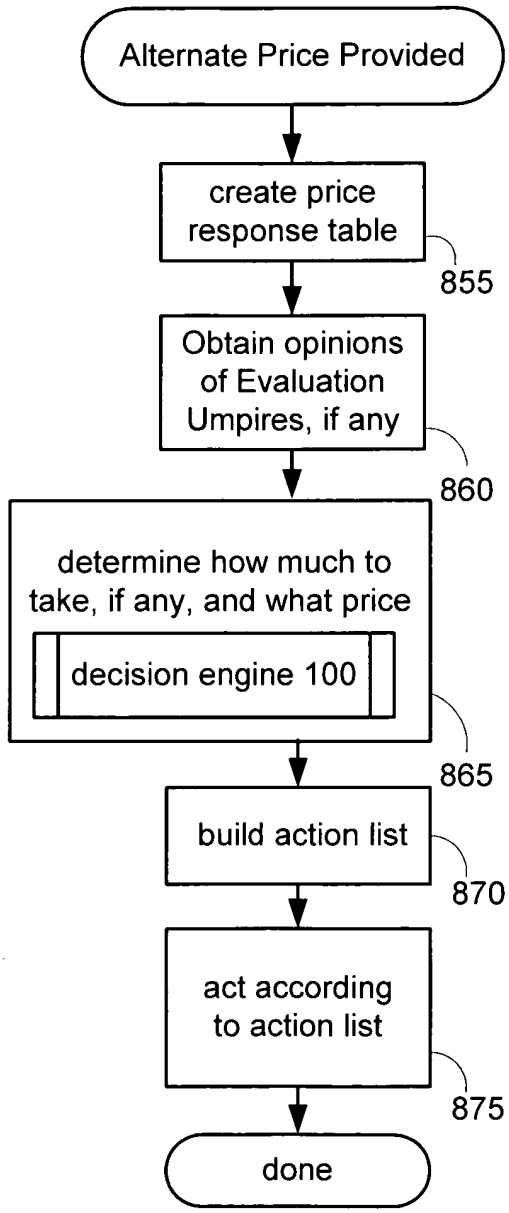

Alternate Price Provided
create price response table
855
Obtain opinions of Evaluation Umpires, if any
860
determine how much to take, if any, and what price
decision engine 100
865
build action list
870
act according to action list
875
done

FIG. 36

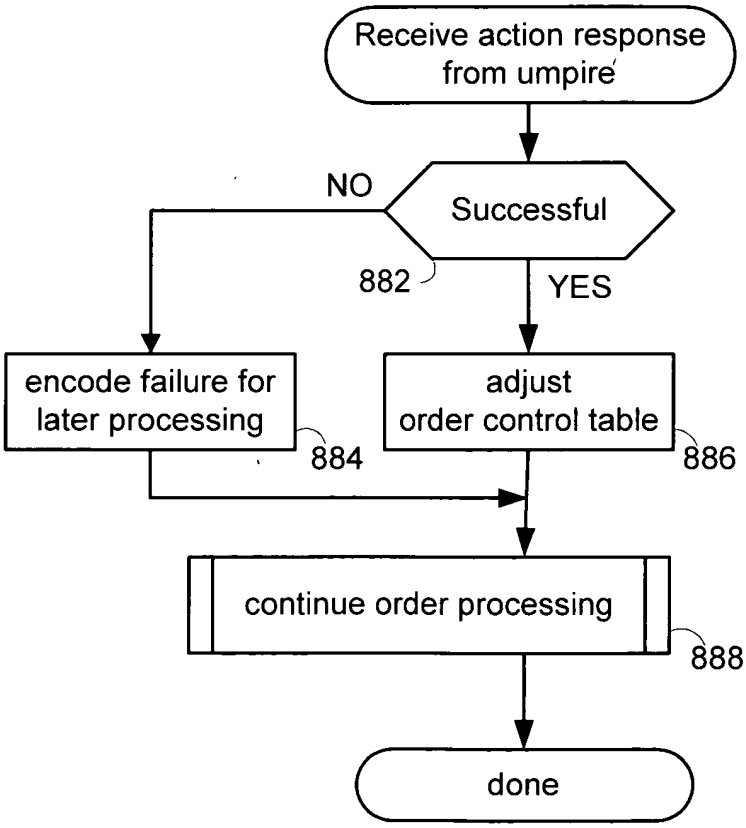

Receive action response from umpire
NO
Successful
882
YES
encode failure for later processing
884
adjust order control table
886
continue order processing
888
done

FIG. 37

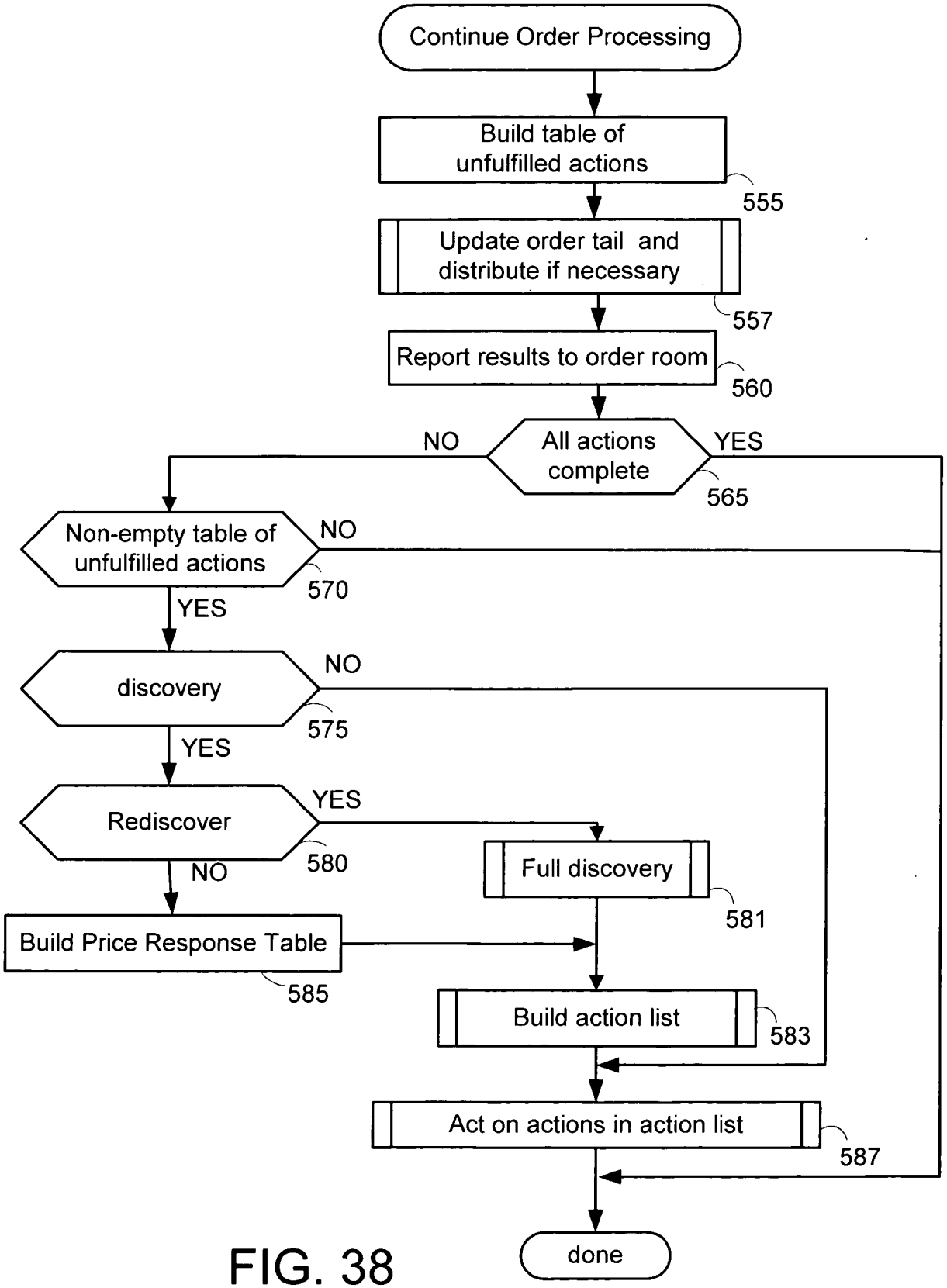

Continue Order Processing
Build table of unfulfilled actions
555
Update order tail and distribute if necessary
557
Report results to order room
560
All actions complete
NO
YES
565
Non-empty table of unfulfilled actions
NO
570
YES
discovery
NO
575
YES
Rediscover
YES
580
NO
Full discovery
581
Build Price Response Table
585
Build action list
583
Act on actions in action list
587
done

FIG. 38

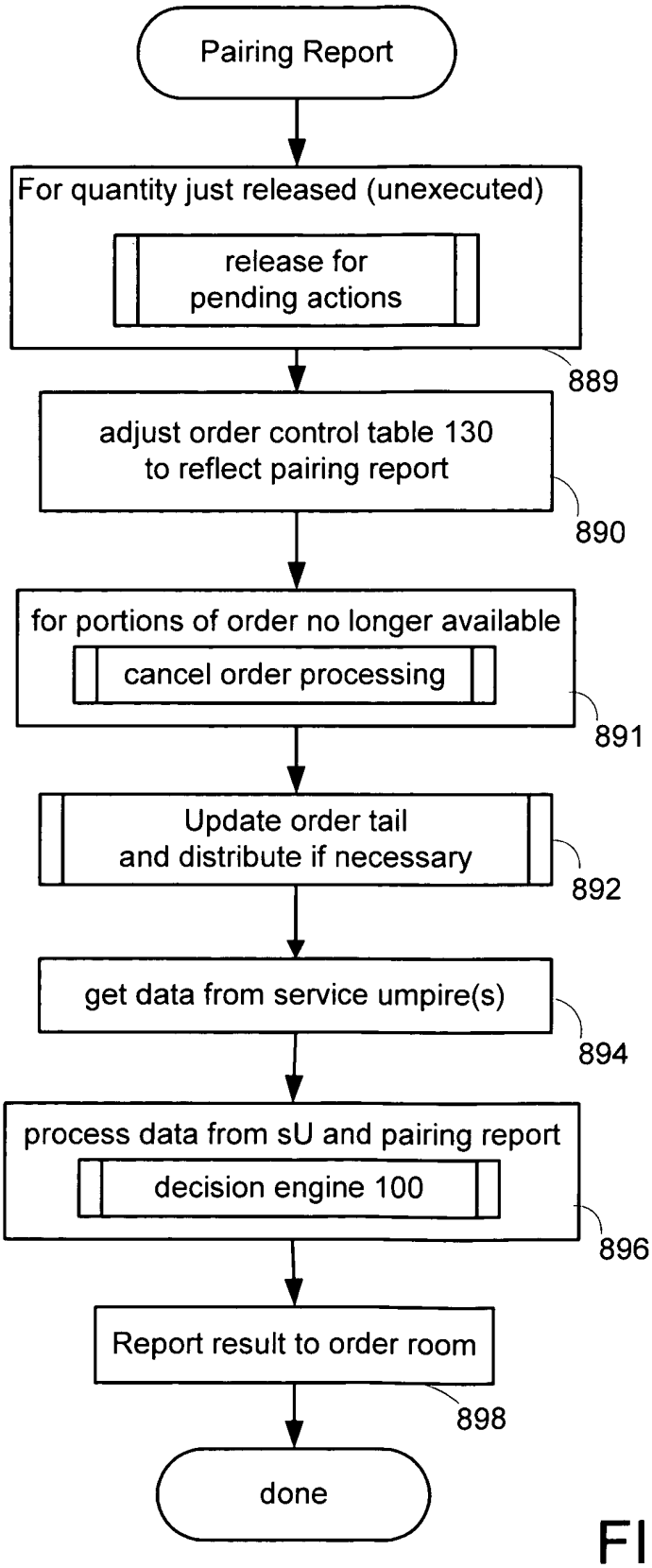

Pairing Report
For quantity just released (unexecuted)
release for pending actions
889
adjust order control table 130 to reflect pairing report
890
for portions of order no longer available
cancel order processing
891
Update order tail and distribute if necessary
892
get data from service umpire(s)
894
process data from sU and pairing report
decision engine 100
896
Report result to order room
898
done

FIG. 39

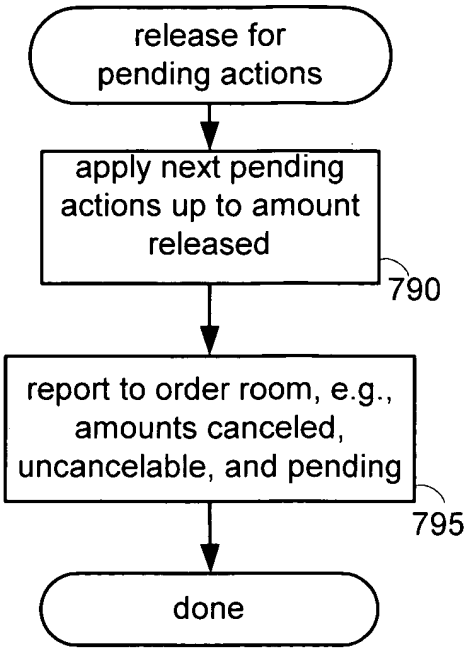

release for pending actions
apply next pending actions up to amount released
790
report to order room, e.g., amounts canceled, uncancelable, and pending
795
done

FIG. 40

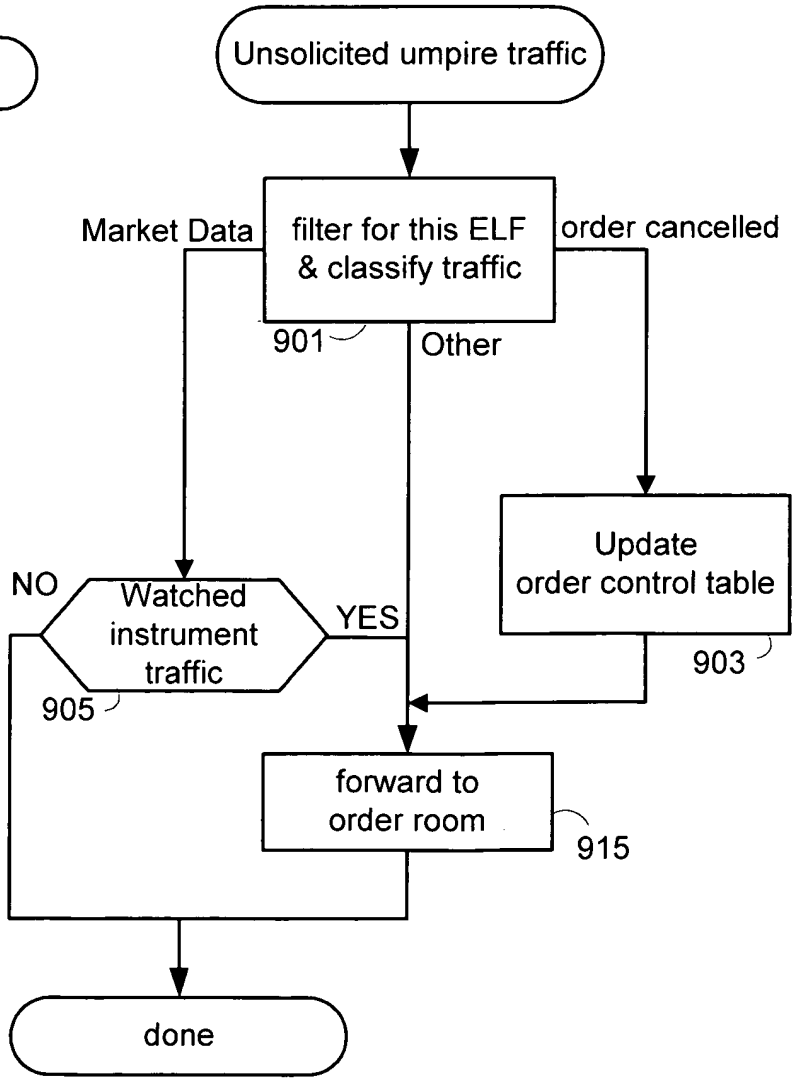

Unsolicited umpire traffic
filter for this ELF & classify traffic
Market Data
order cancelled
901
Other
Update order control table
903
NO
Watched instrument traffic
YES
905
forward to order room
915
done

FIG. 41

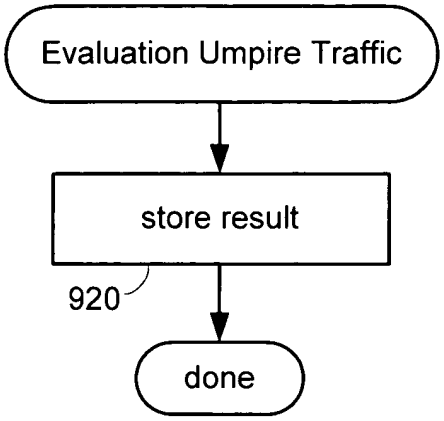

Evaluation Umpire Traffic
store result
920
done

FIG. 42

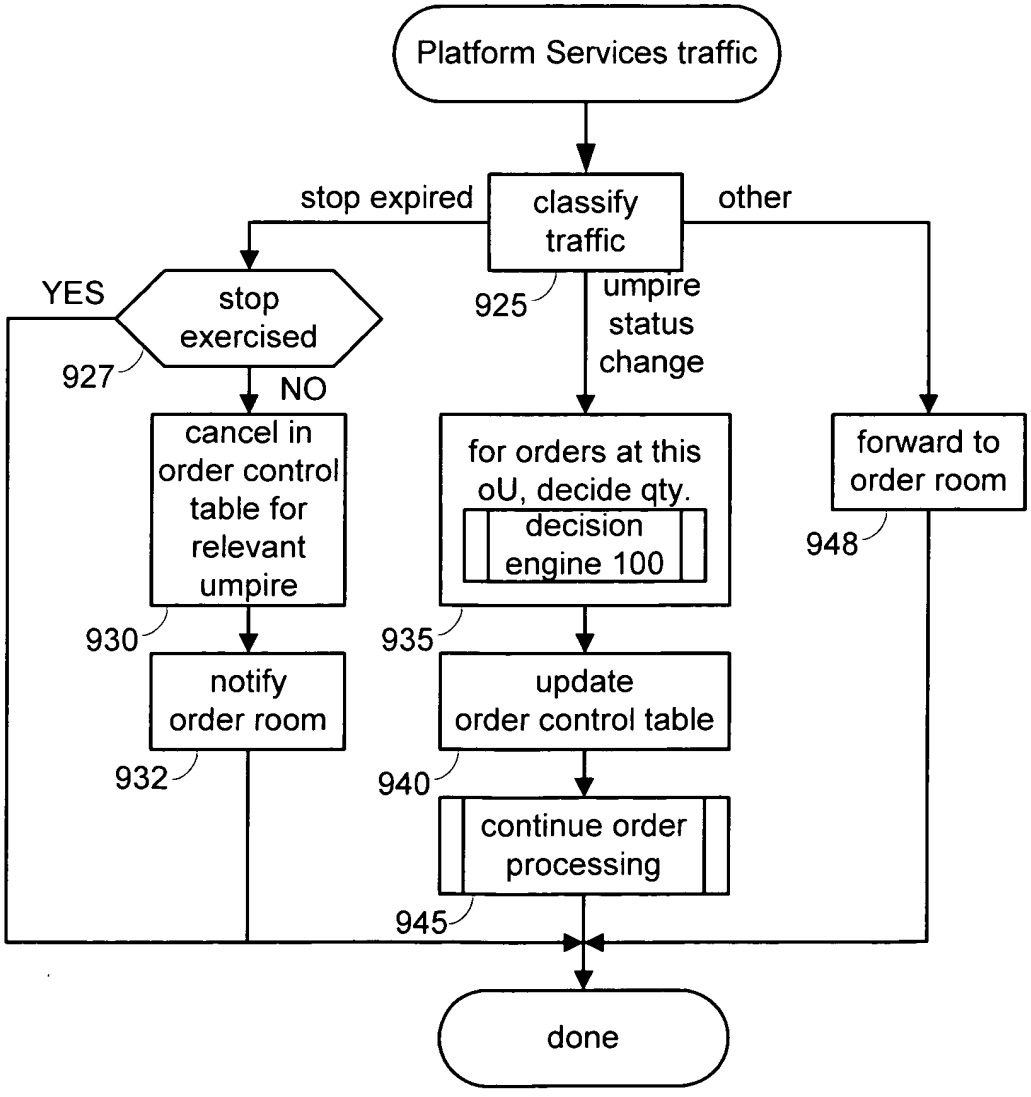

Platform Services traffic
classify traffic
925
stop expired
other
umpire status change
YES
stop exercised
927
NO
cancel in order control table for relevant umpire
930
notify order room
932
for orders at this oU, decide qty.
decision engine 100
935
update order control table
940
continue order processing
945
forward to order room
948
done

FIG. 43

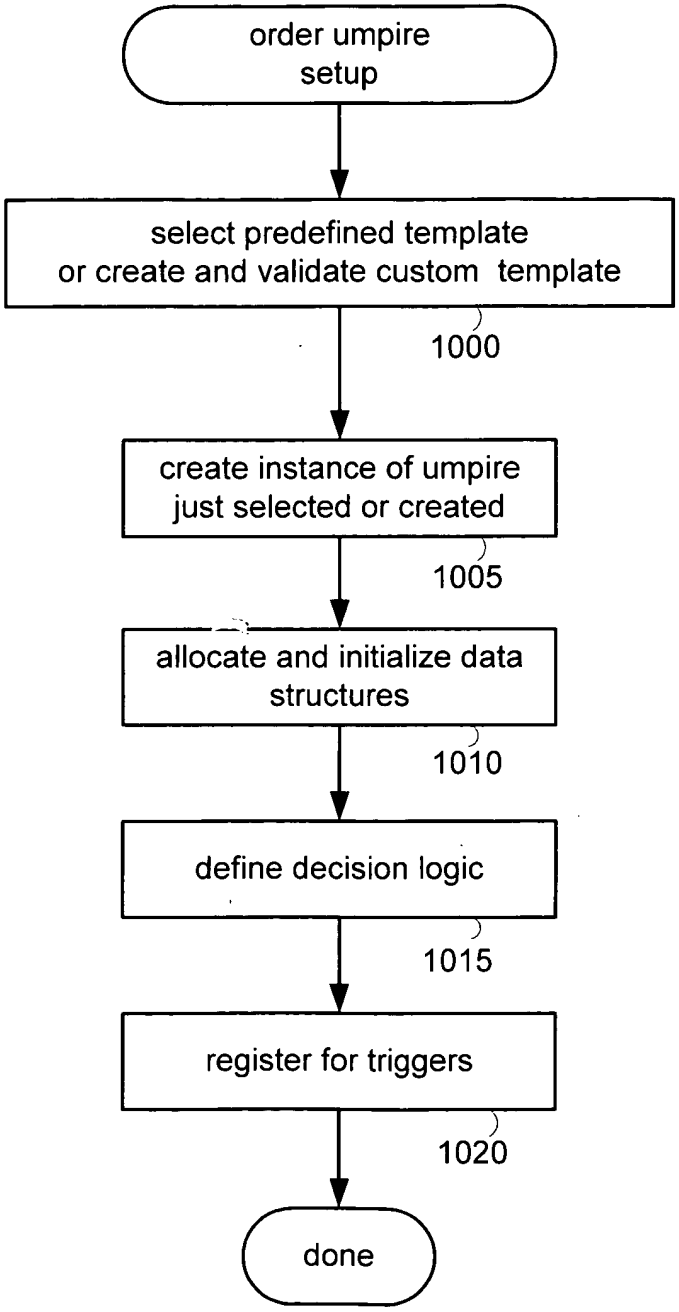
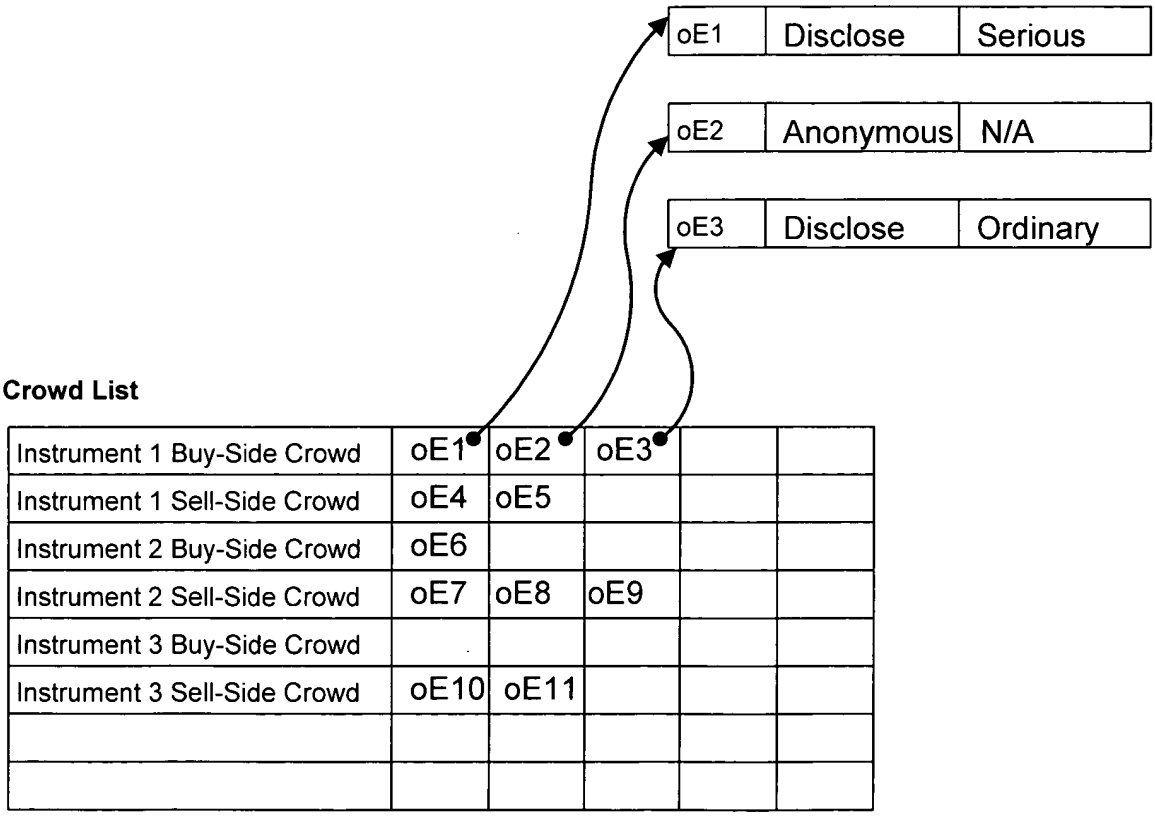

order umpire setup
select predefined template or create and validate custom template
1000
create instance of umpire just selected or created
1005
allocate and initialize data structures
1010
define decision logic
1015
register for triggers
1020
done

FIG. 44



Crowd List

Instrument 1 Buy-Side Crowd	oE1	oE2	oE3		
Instrument 1 Sell-Side Crowd	oE4	oE5			
Instrument 2 Buy-Side Crowd	oE6				
Instrument 2 Sell-Side Crowd	oE7	oE8	oE9		
Instrument 3 Buy-Side Crowd					
Instrument 3 Sell-Side Crowd	oE10	oE11			

FIG. 45

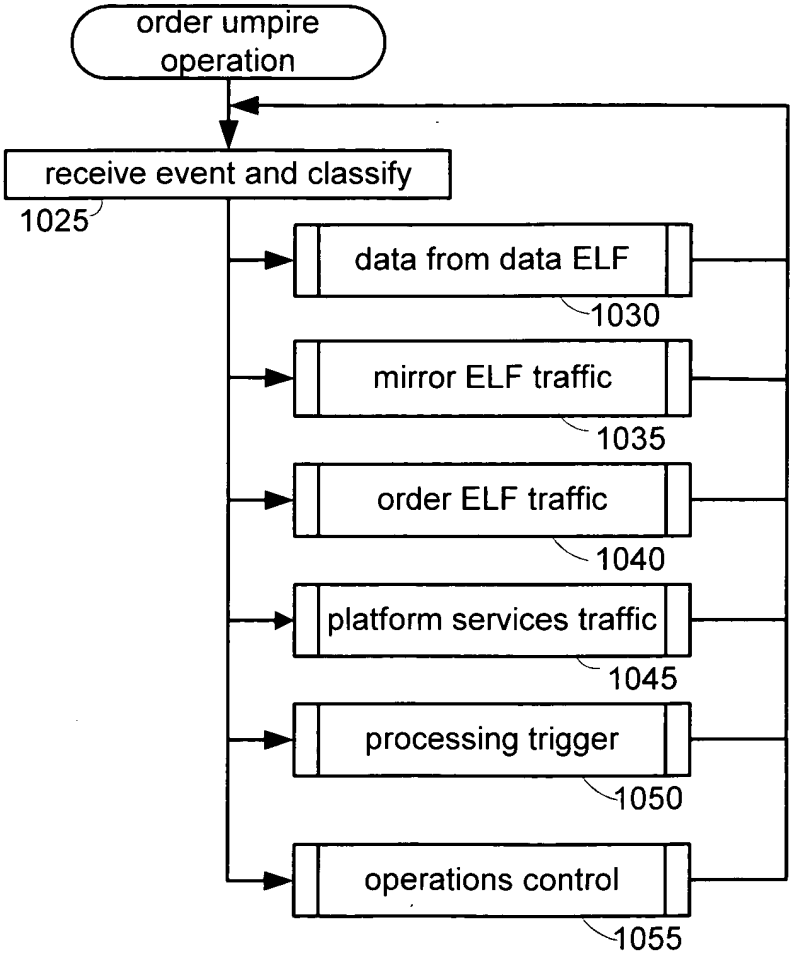

order umpire operation
receive event and classify
1025
data from data ELF
1030
mirror ELF traffic
1035
order ELF traffic
1040
platform services traffic
1045
processing trigger
1050
operations control
1055

FIG. 46

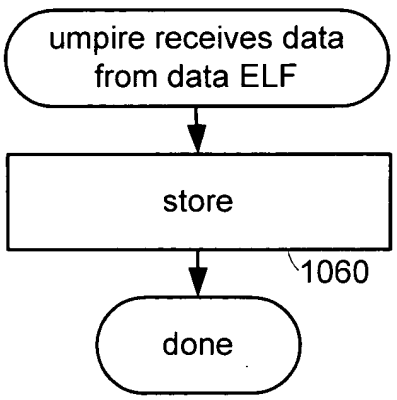

umpire receives data from data ELF
store
1060
done

FIG. 47

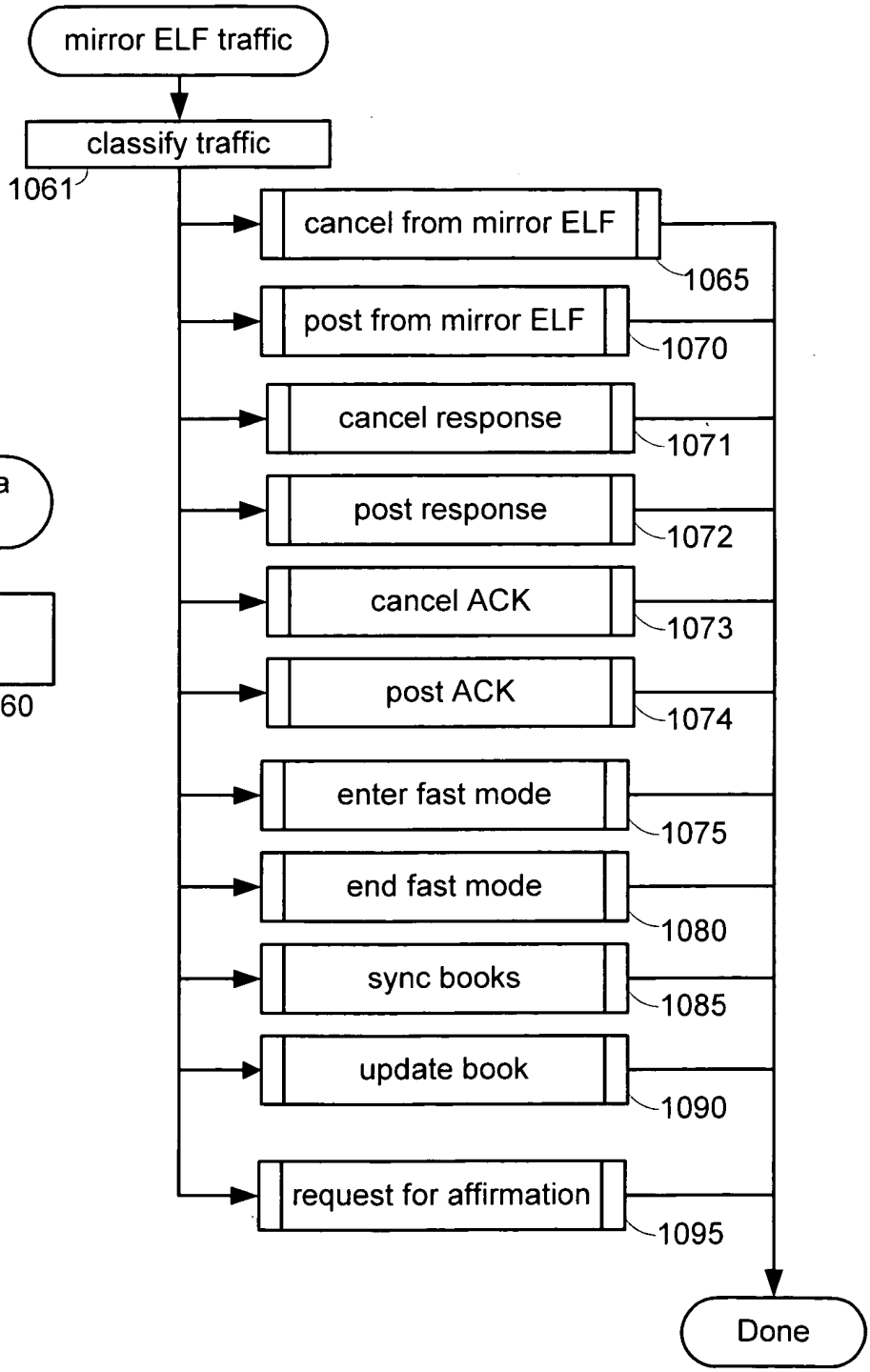

mirror ELF traffic
classify traffic
1061
cancel from mirror ELF
1065
post from mirror ELF
1070
cancel response
1071
post response
1072
cancel ACK
1073
post ACK
1074
enter fast mode
1075
end fast mode
1080
sync books
1085
update book
1090
request for affirmation
1095
Done

FIG. 48

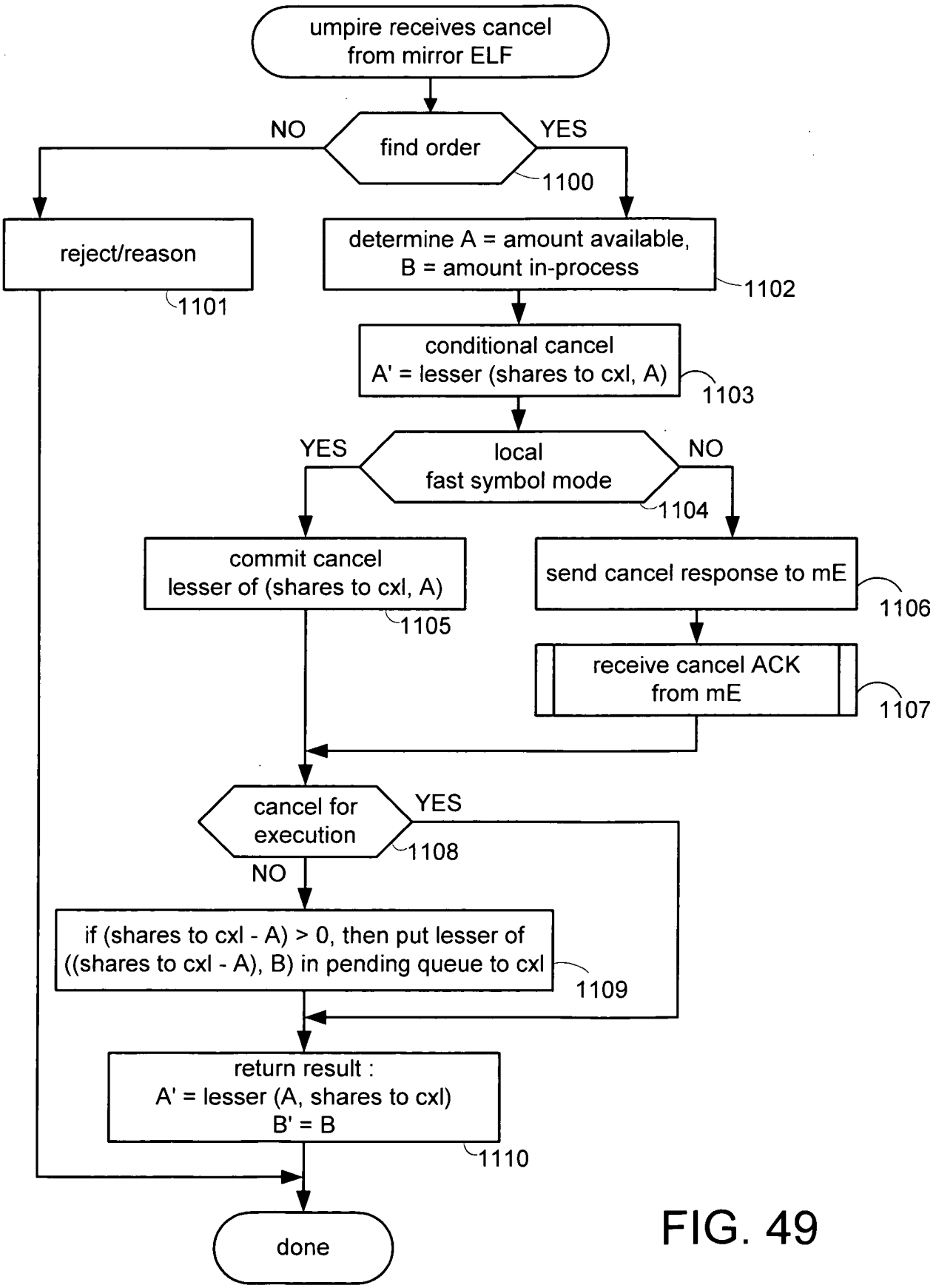

umpire receives cancel from mirror ELF
find order
NO
YES
1100
reject/reason
1101
determine A = amount available, B = amount in-process
1102
conditional cancel A' = lesser (shares to cxl, A)
1103
local fast symbol mode
YES
NO
1104
commit cancel lesser of (shares to cxl, A)
1105
send cancel response to mE
1106
receive cancel ACK from mE
1107
cancel for execution
YES
1108
NO
if (shares to cxl - A) > 0, then put lesser of ((shares to cxl - A), B) in pending queue to cxl
1109
return result : A' = lesser (A, shares to cxl) B' = B
1110
done

FIG. 49

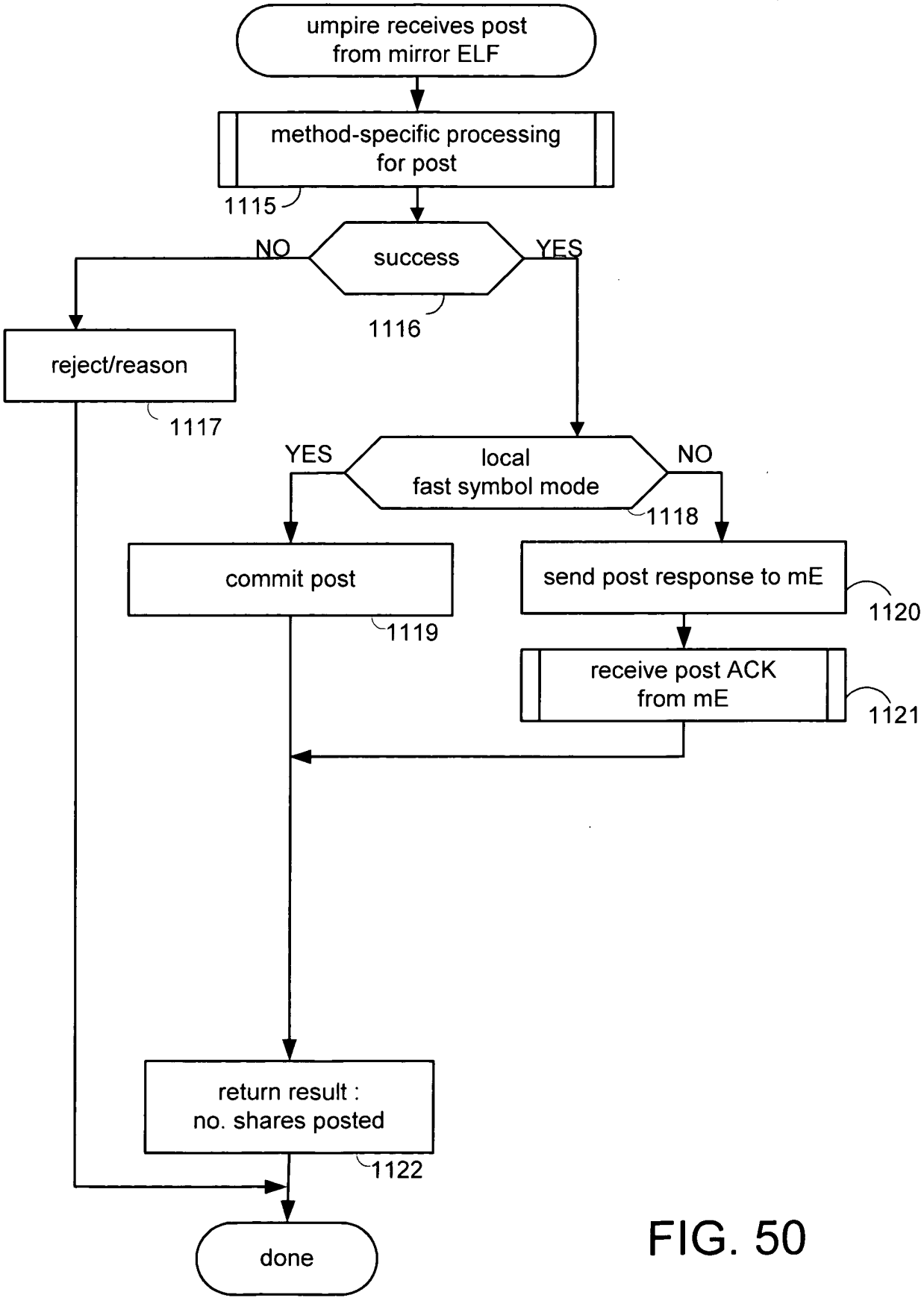

umpire receives post from mirror ELF
method-specific processing for post
1115
success
NO
YES
1116
reject/reason
1117
local fast symbol mode
YES
NO
1118
commit post
1119
send post response to mE
1120
receive post ACK from mE
1121
return result : no. shares posted
1122
done

FIG. 50

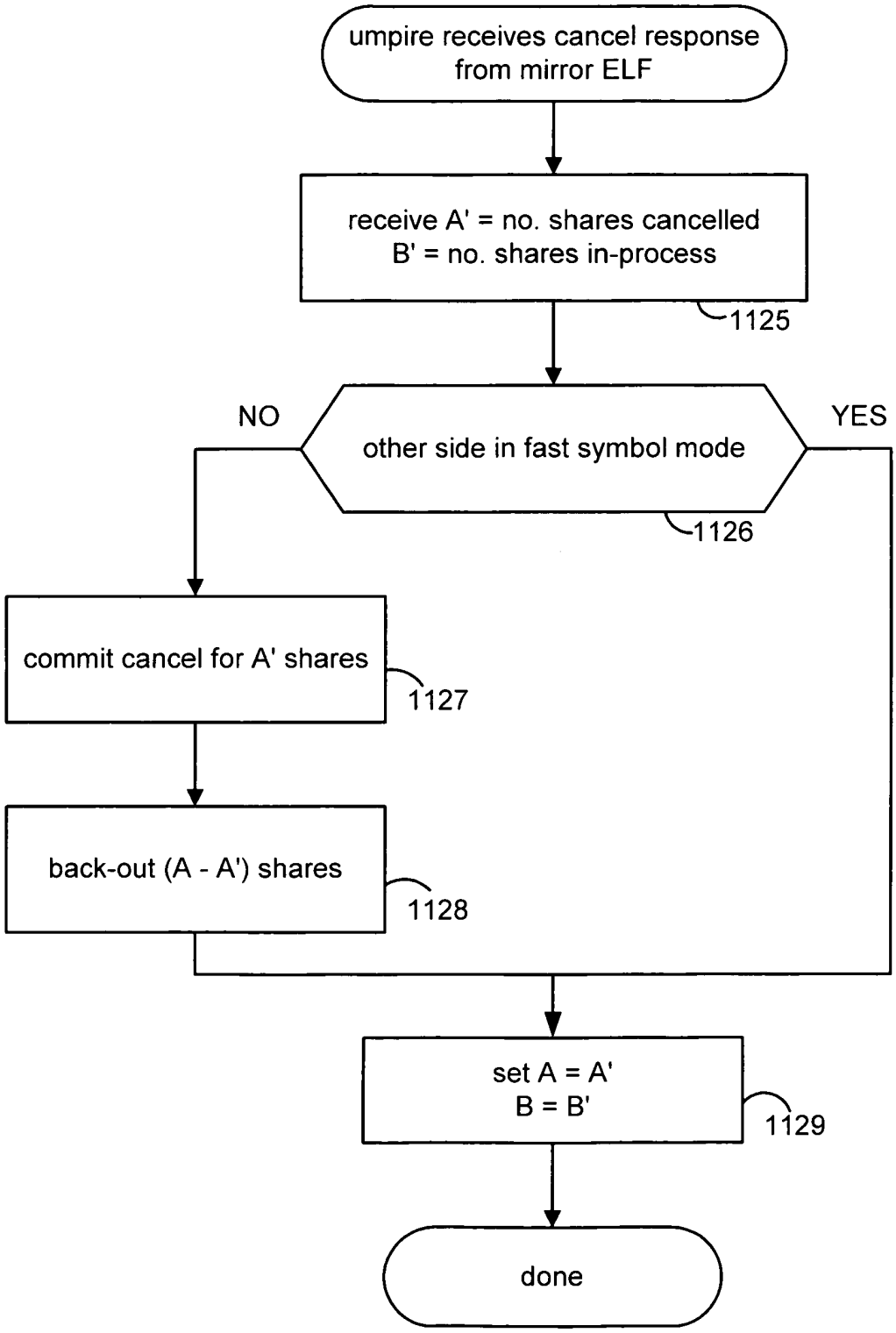

umpire receives cancel response from mirror ELF
receive A' = no. shares cancelled
B' = no. shares in-process
1125
NO
other side in fast symbol mode
YES
1126
commit cancel for A' shares
1127
back-out (A - A') shares
1128
set A = A'
B = B'
1129
done

FIG. 51

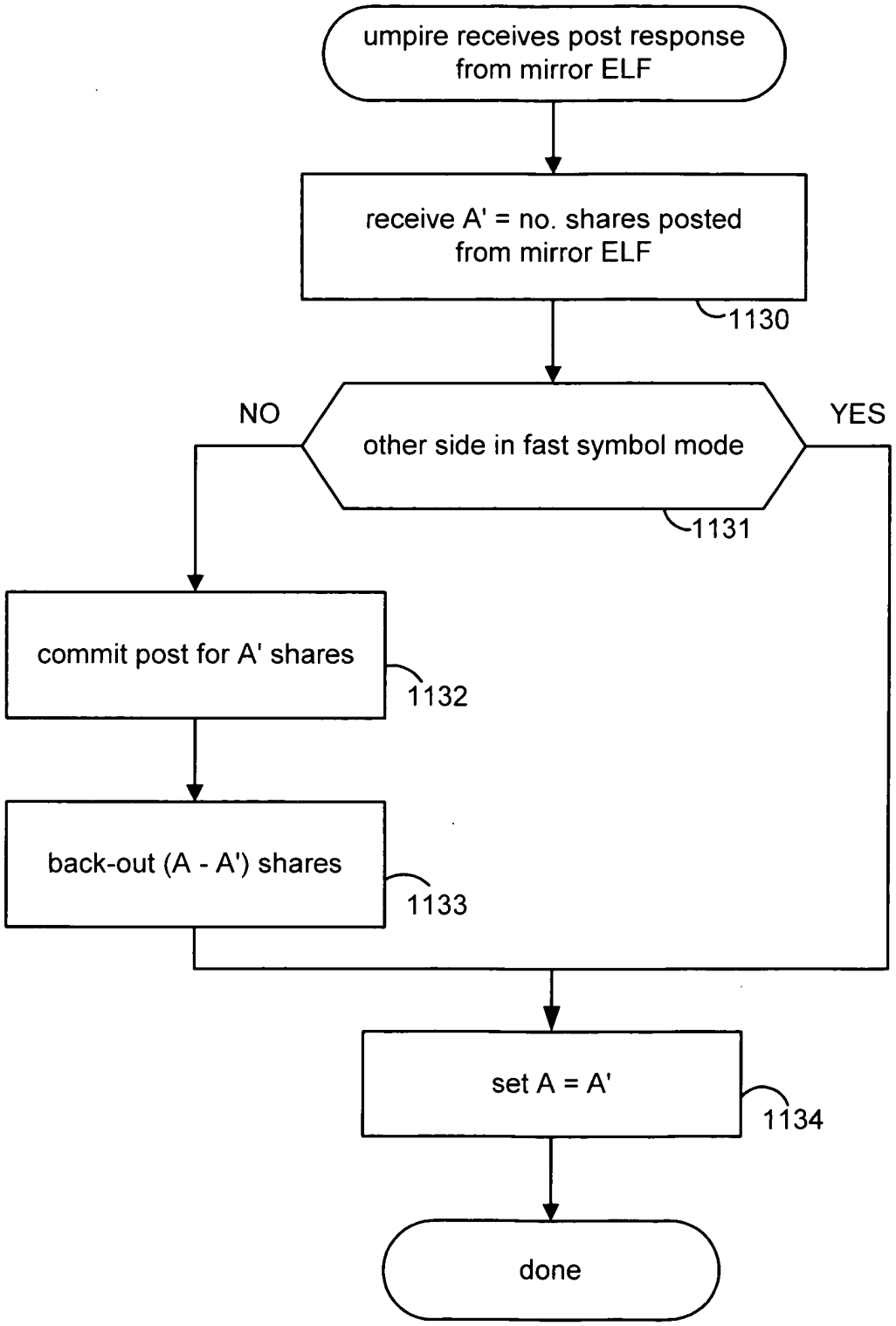

umpire receives post response from mirror ELF
receive A' = no. shares posted from mirror ELF
1130
NO
other side in fast symbol mode
YES
1131
commit post for A' shares
1132
back-out (A - A') shares
1133
set A = A'
1134
done

FIG. 52

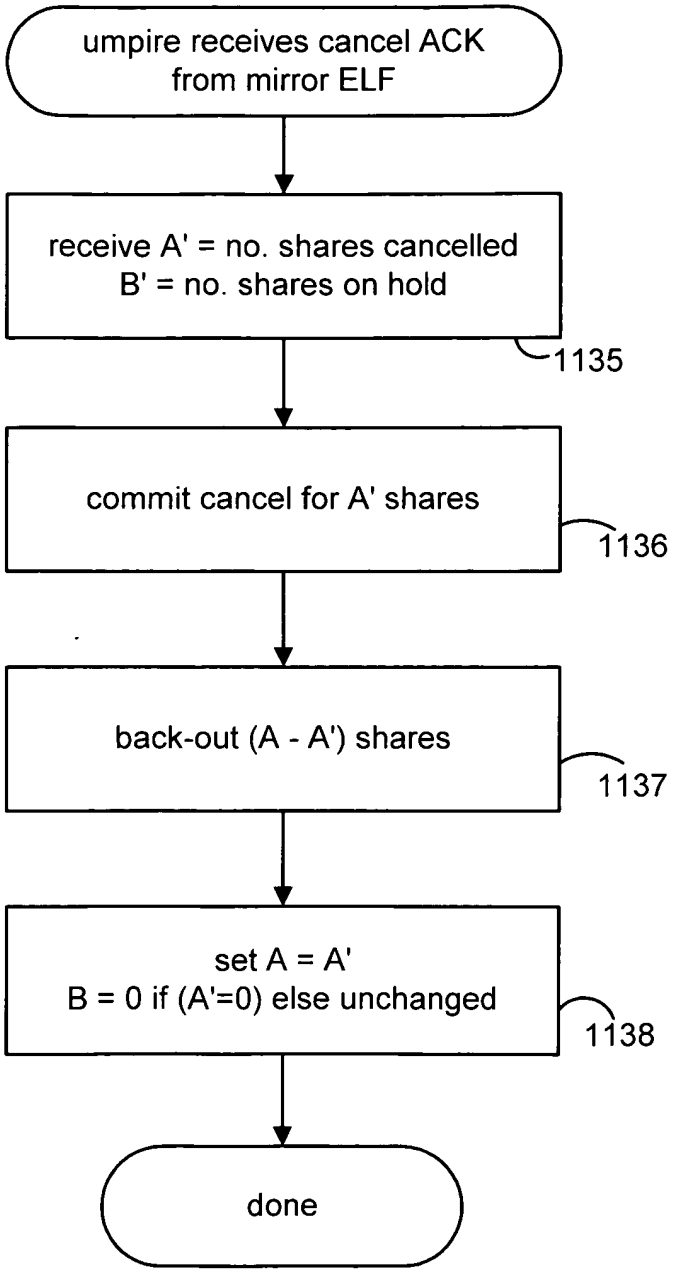

umpire receives cancel ACK from mirror ELF
receive A' = no. shares cancelled
B' = no. shares on hold
1135
commit cancel for A' shares
1136
back-out (A - A') shares
1137
set A = A'
B = 0 if (A'=0) else unchanged
1138
done

FIG. 53

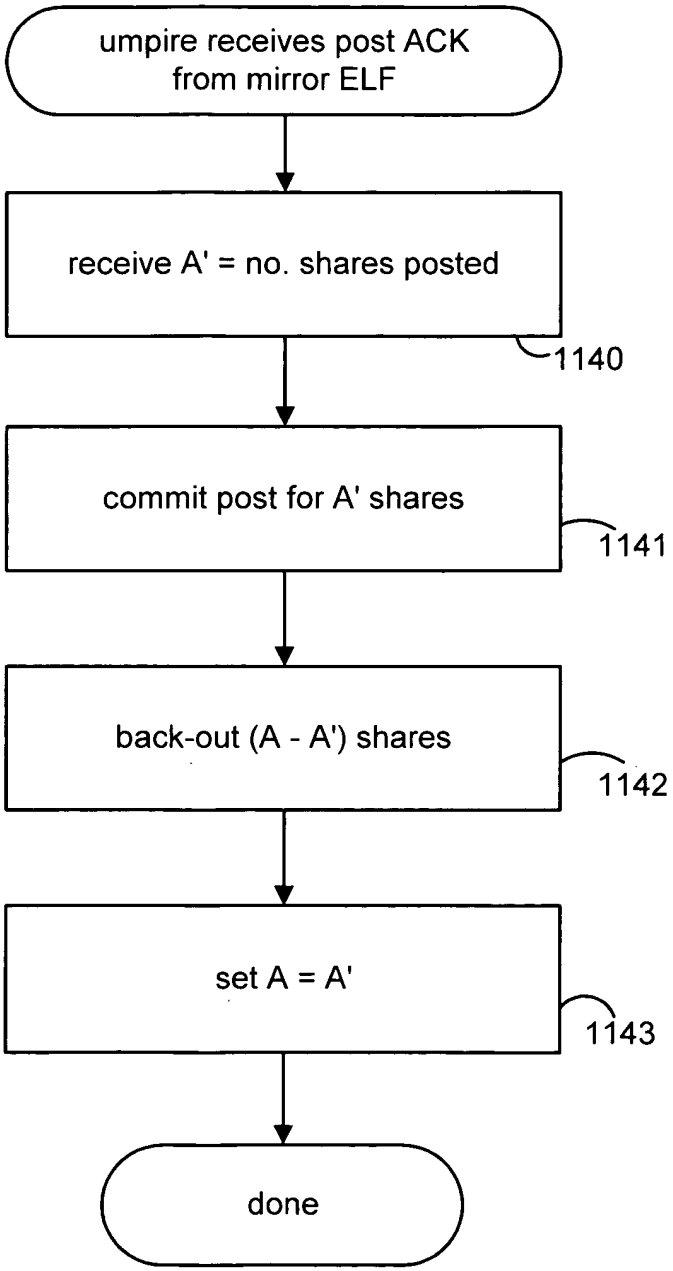

umpire receives post ACK from mirror ELF
receive A' = no. shares posted
1140
commit post for A' shares
1141
back-out (A - A') shares
1142
set A = A'
1143
done

FIG. 54

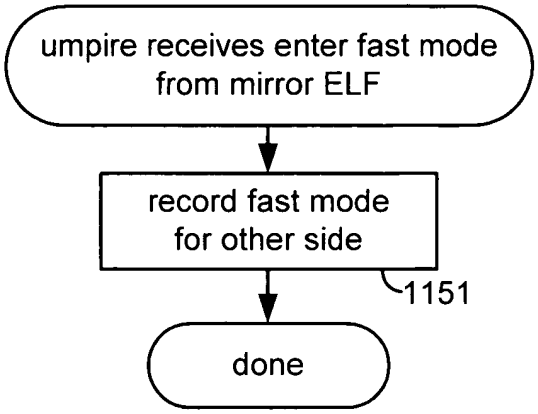


FIG. 55A

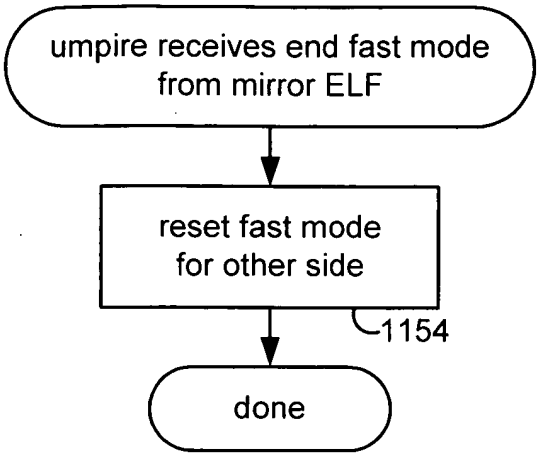


FIG. 55B

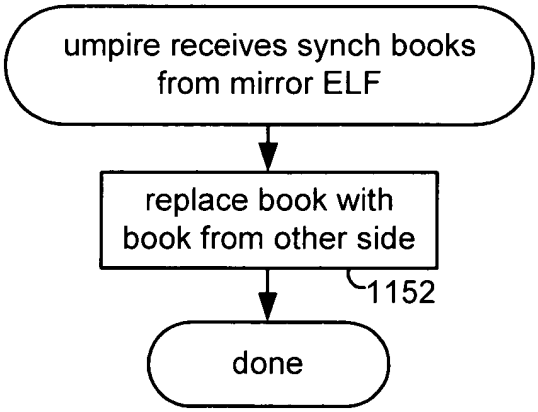


FIG. 56

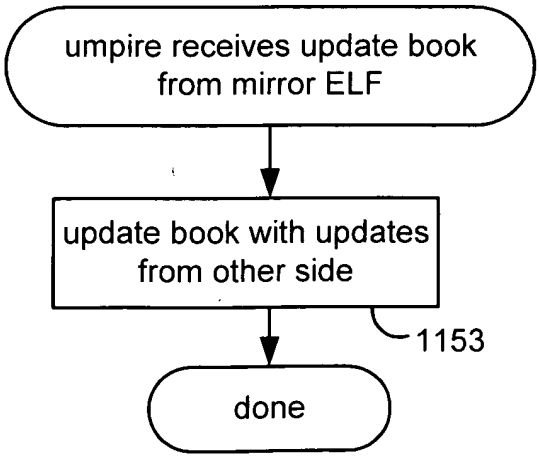


FIG. 57

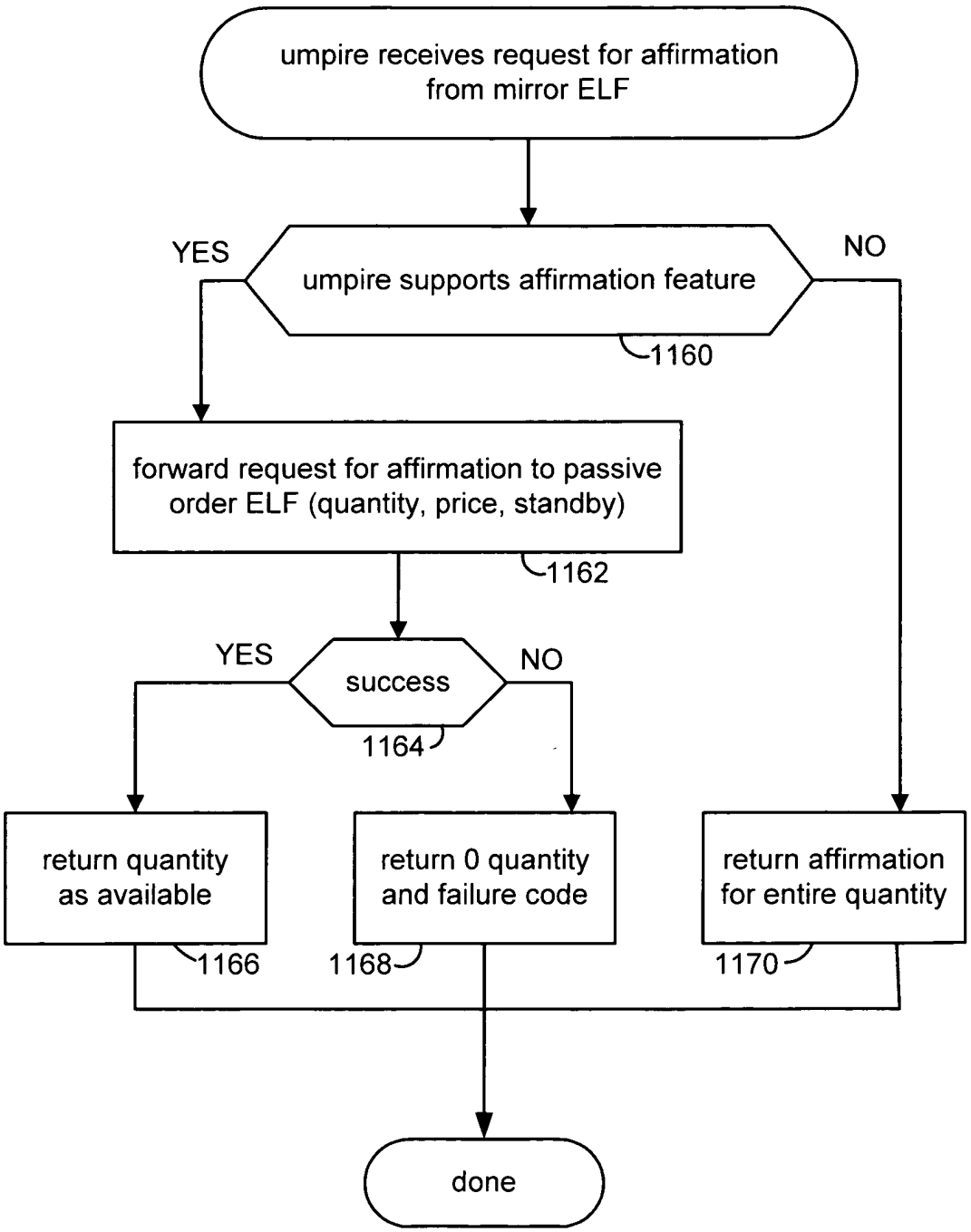

umpire receives request for affirmation from mirror ELF
YES
umpire supports affirmation feature
NO
1160
forward request for affirmation to passive order ELF (quantity, price, standby)
1162
YES
success
NO
1164
return quantity as available
return 0 quantity and failure code
return affirmation for entire quantity
1166
1168
1170
done

FIG. 58

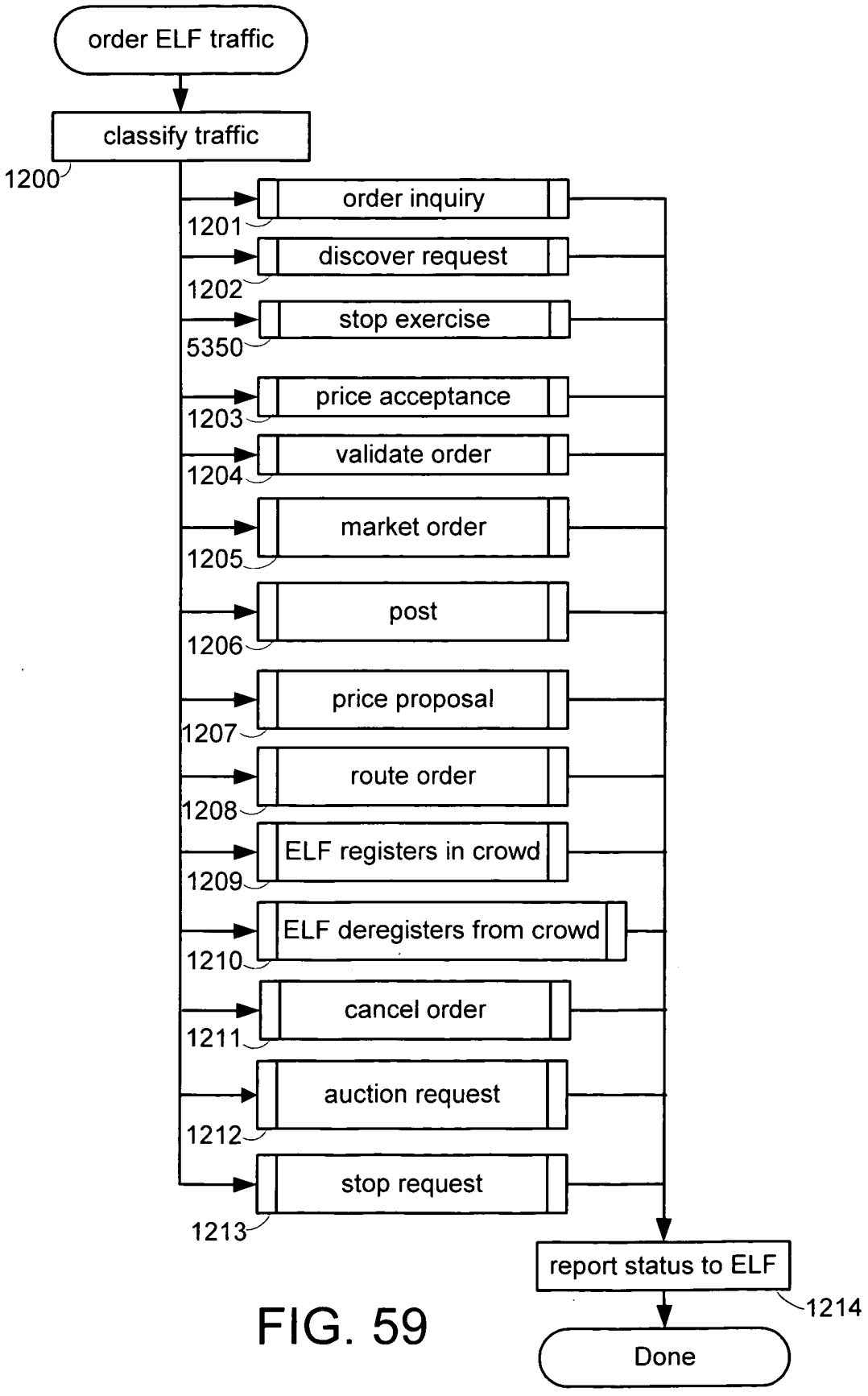

order ELF traffic
classify traffic
1200
order inquiry
1201
discover request
1202
stop exercise
5350
price acceptance
1203
validate order
1204
market order
1205
post
1206
price proposal
1207
route order
1208
ELF registers in crowd
1209
ELF deregisters from crowd
1210
cancel order
1211
auction request
1212
stop request
1213
report status to ELF
1214
Done

FIG. 59

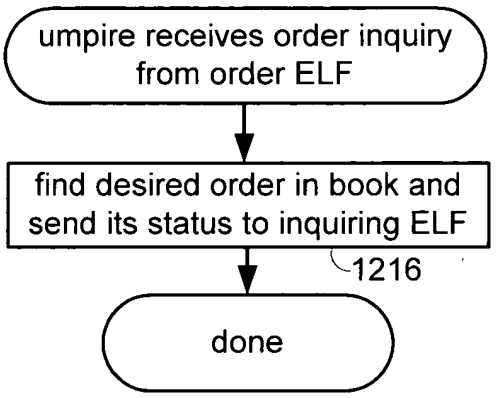

umpire receives order inquiry from order ELF
find desired order in book and send its status to inquiring ELF
1216
done

FIG. 60

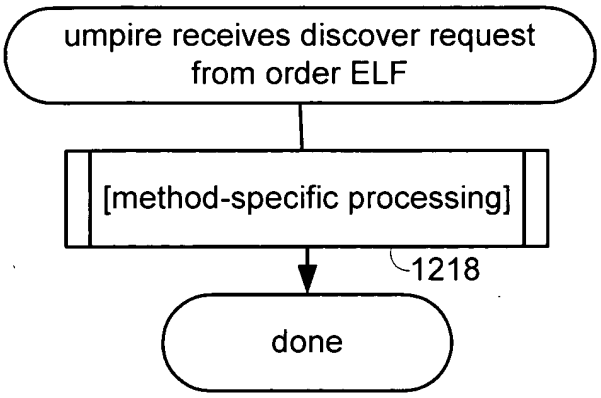

umpire receives discover request from order ELF
[method-specific processing]
1218
done

FIG. 61

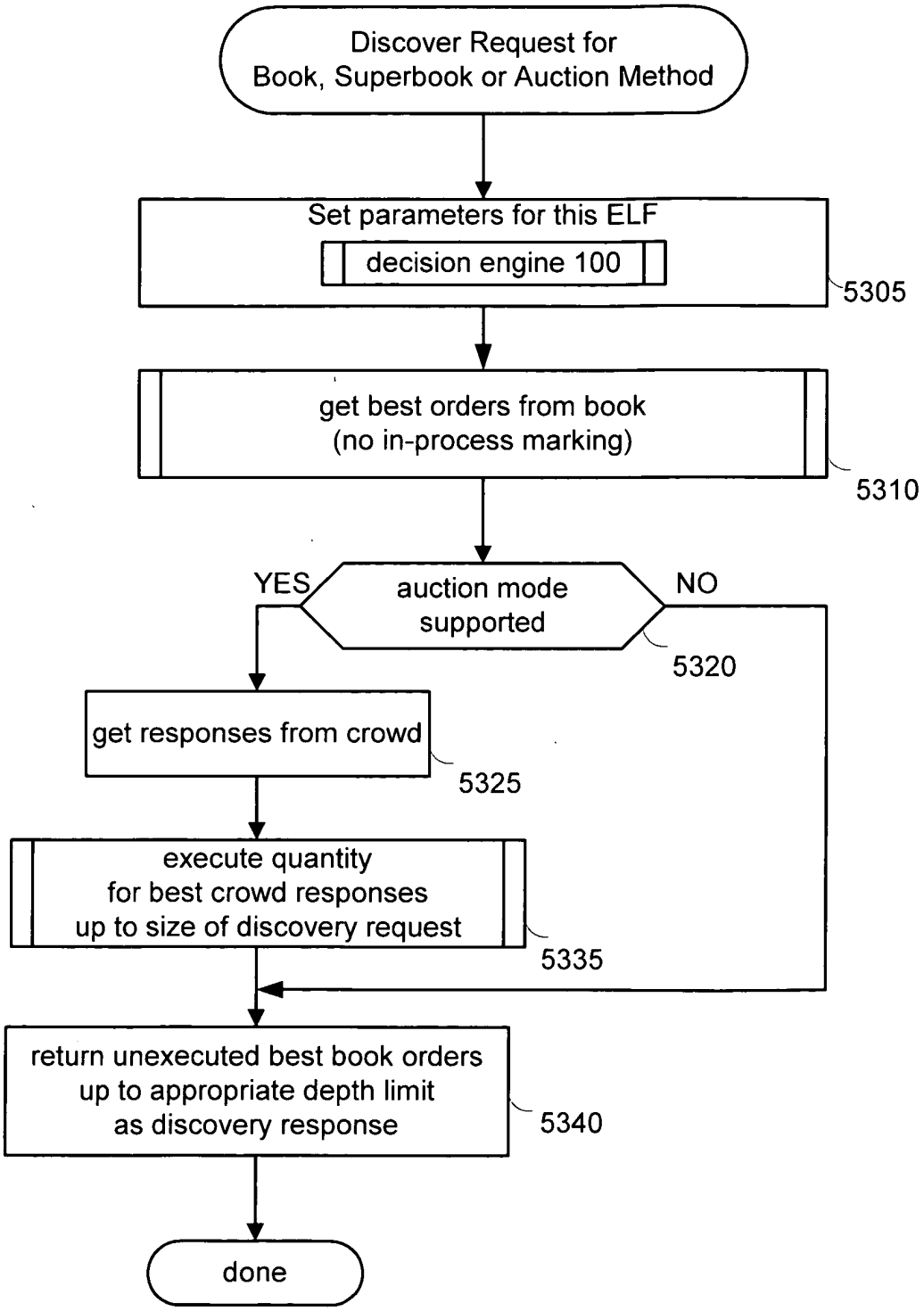

Discover Request for
Book, Superbook or Auction Method
Set parameters for this ELF
decision engine 100
5305
get best orders from book
(no in-process marking)
5310
YES
auction mode
supported
NO
5320
get responses from crowd
5325
execute quantity
for best crowd responses
up to size of discovery request
5335
return unexecuted best book orders
up to appropriate depth limit
as discovery response
5340
done

FIG. 62

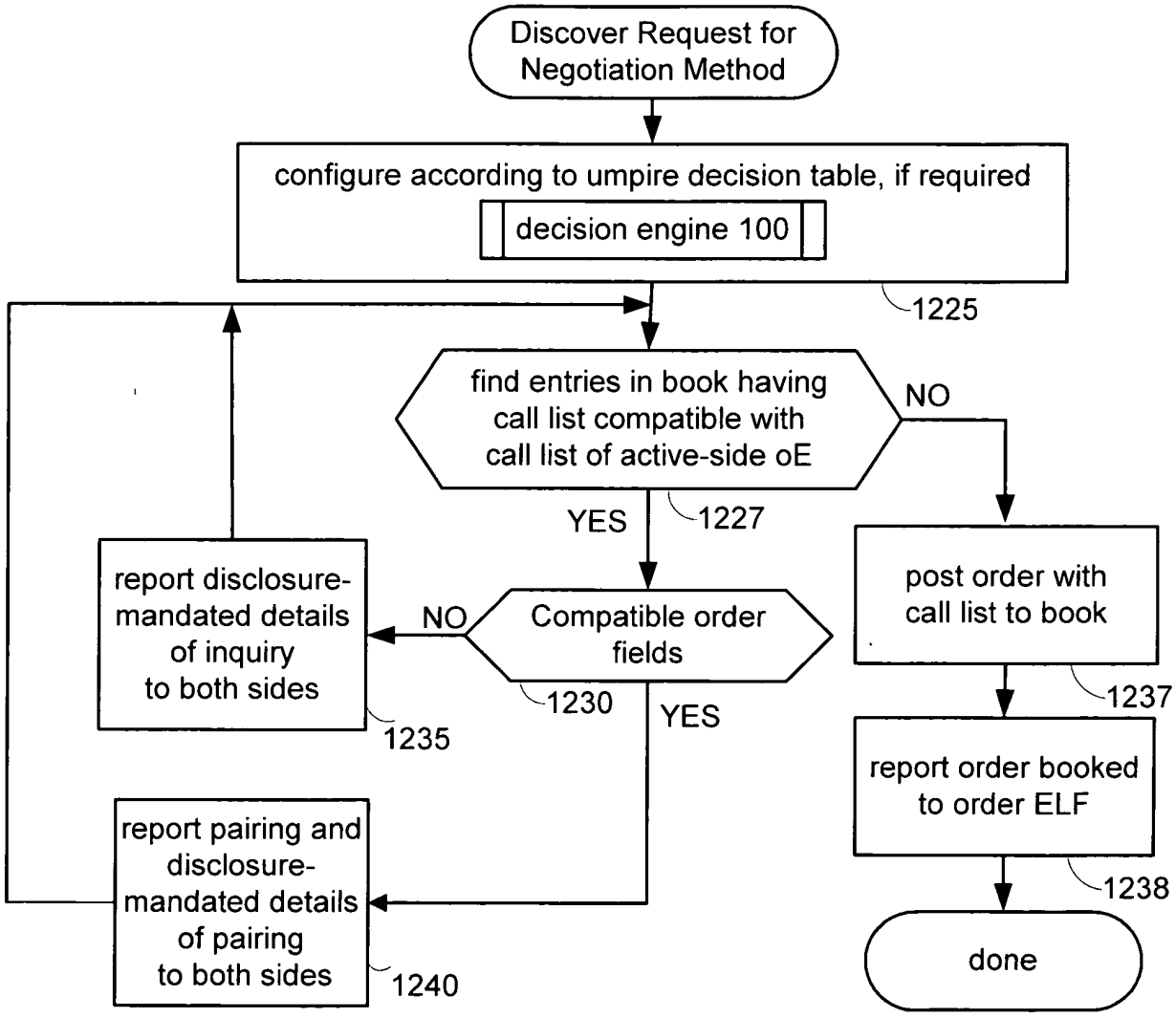

Discover Request for Negotiation Method
configure according to umpire decision table, if required
decision engine 100
1225
find entries in book having call list compatible with call list of active-side oE
NO
YES
1227
post order with call list to book
1237
report order booked to order ELF
1238
done
Compatible order fields
NO
1230
YES
report disclosure-mandated details of inquiry to both sides
1235
report pairing and disclosure-mandated details of pairing to both sides
1240

FIG. 63

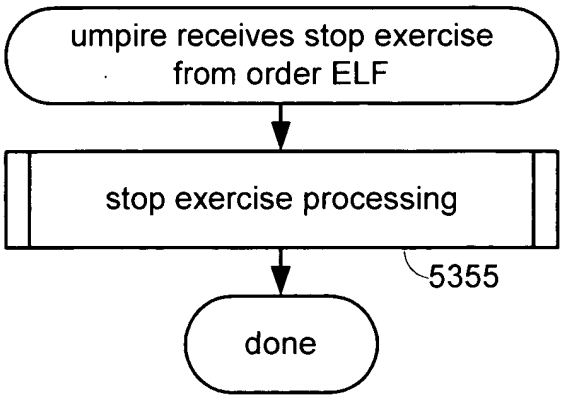


FIG. 64A

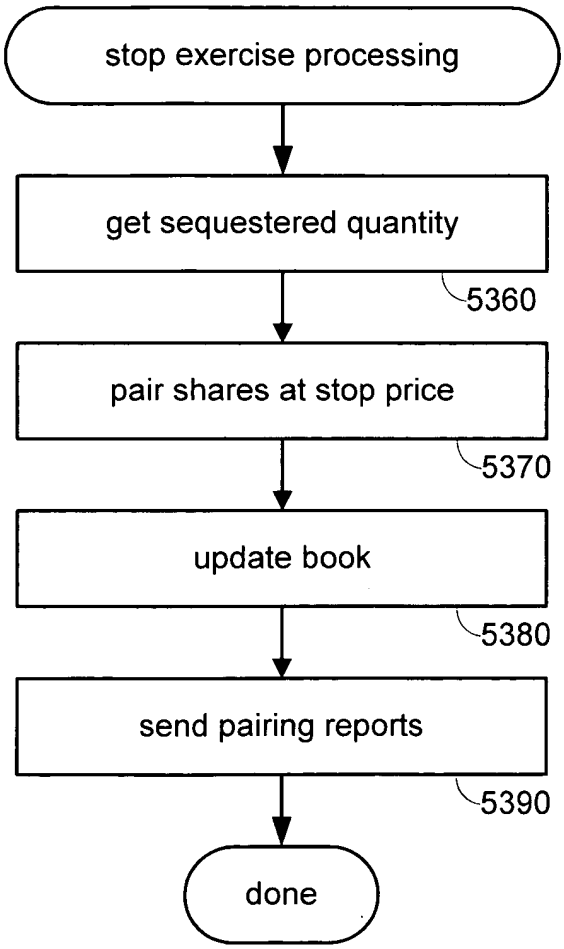


FIG. 64B

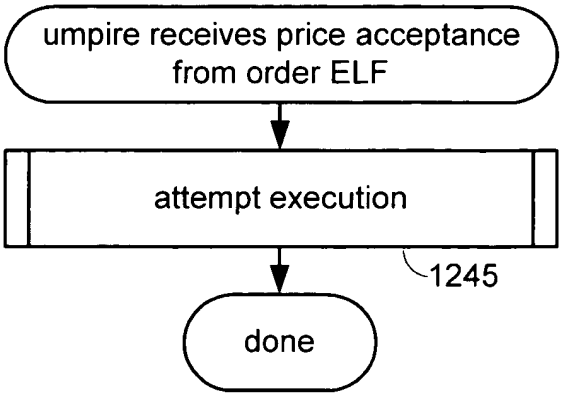


FIG. 64C

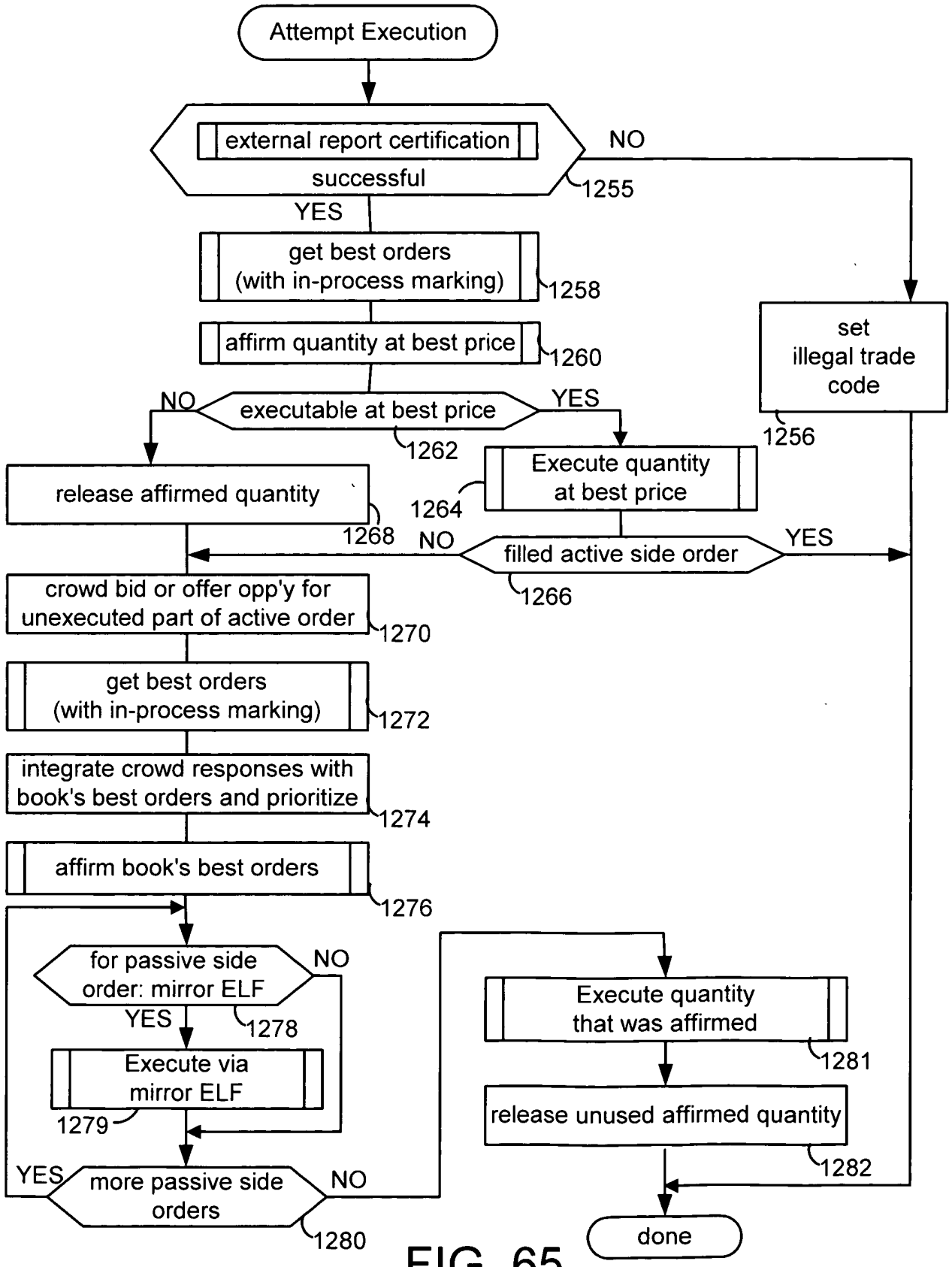

Attempt Execution
external report certification successful
NO
1255
YES
get best orders (with in-process marking)
1258
affirm quantity at best price
1260
set illegal trade code
1256
NO
executable at best price
YES
1262
release affirmed quantity
1268
Execute quantity at best price
1264
NO
filled active side order
YES
1266
crowd bid or offer opp'y for unexecuted part of active order
1270
get best orders (with in-process marking)
1272
integrate crowd responses with book's best orders and prioritize
1274
affirm book's best orders
1276
for passive side order: mirror ELF
NO
YES
1278
Execute via mirror ELF
1279
YES
more passive side orders
NO
1280
Execute quantity that was affirmed
1281
release unused affirmed quantity
1282
done

FIG. 65

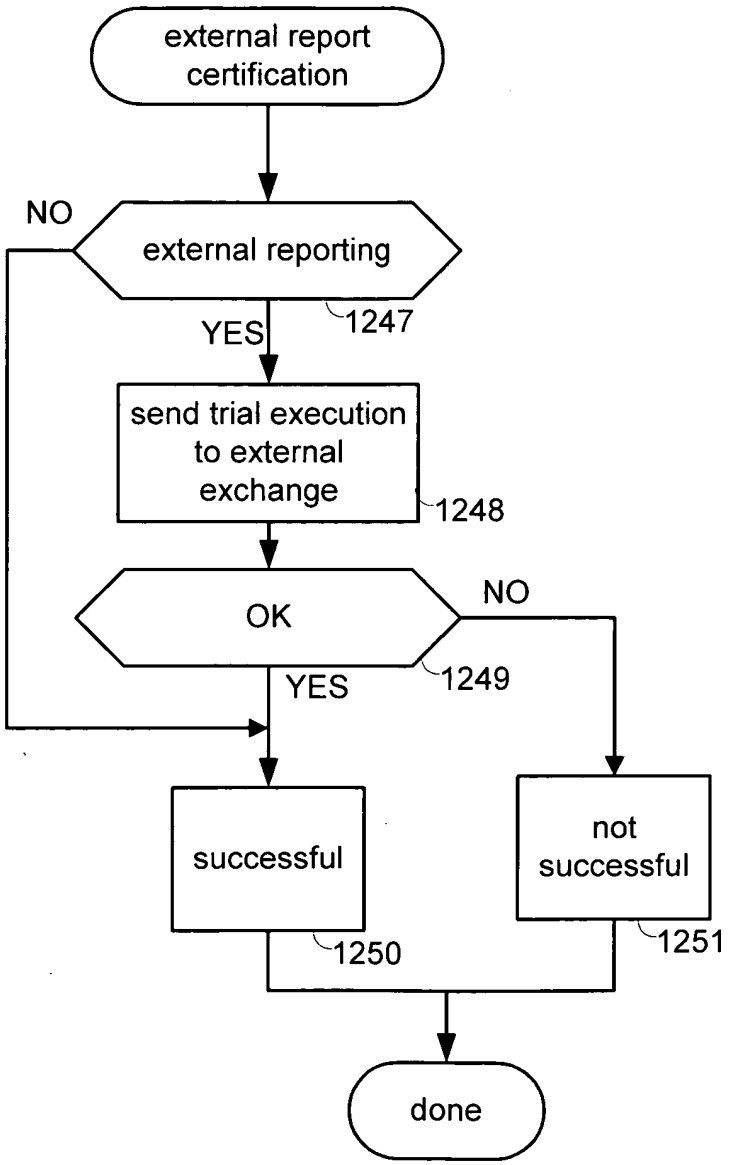

external report certification
NO
external reporting
1247
YES
send trial execution to external exchange
1248
OK
NO
1249
YES
successful
not successful
1250
1251
done

FIG. 66

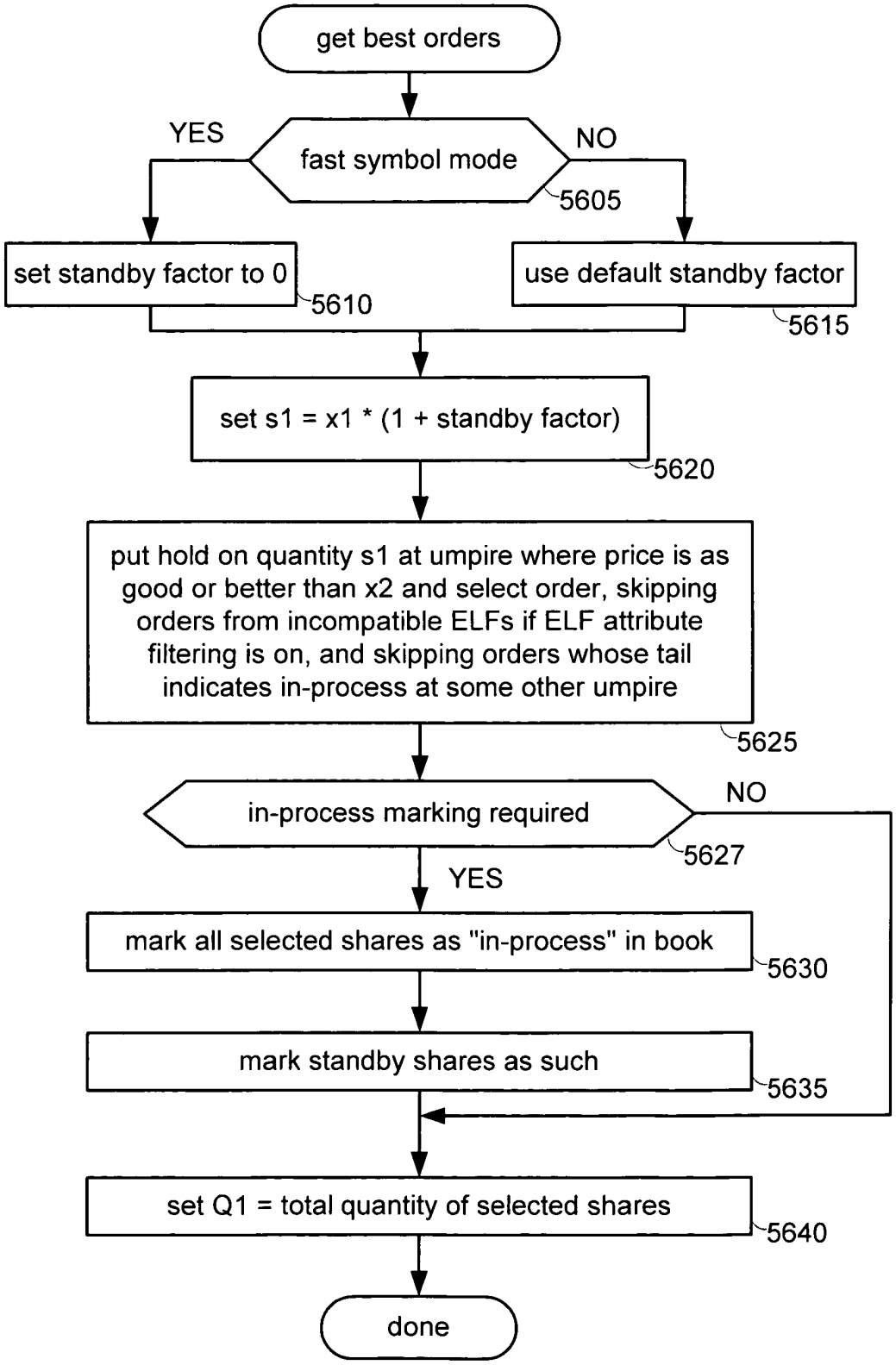

get best orders
YES
fast symbol mode
NO
5605
set standby factor to 0
5610
use default standby factor
5615
set s1 = x1 * (1 + standby factor)
5620
put hold on quantity s1 at umpire where price is as good or better than x2 and select order, skipping orders from incompatible ELFs if ELF attribute filtering is on, and skipping orders whose tail indicates in-process at some other umpire
5625
in-process marking required
NO
5627
YES
mark all selected shares as "in-process" in book
5630
mark standby shares as such
5635
set Q1 = total quantity of selected shares
5640
done

FIG. 67

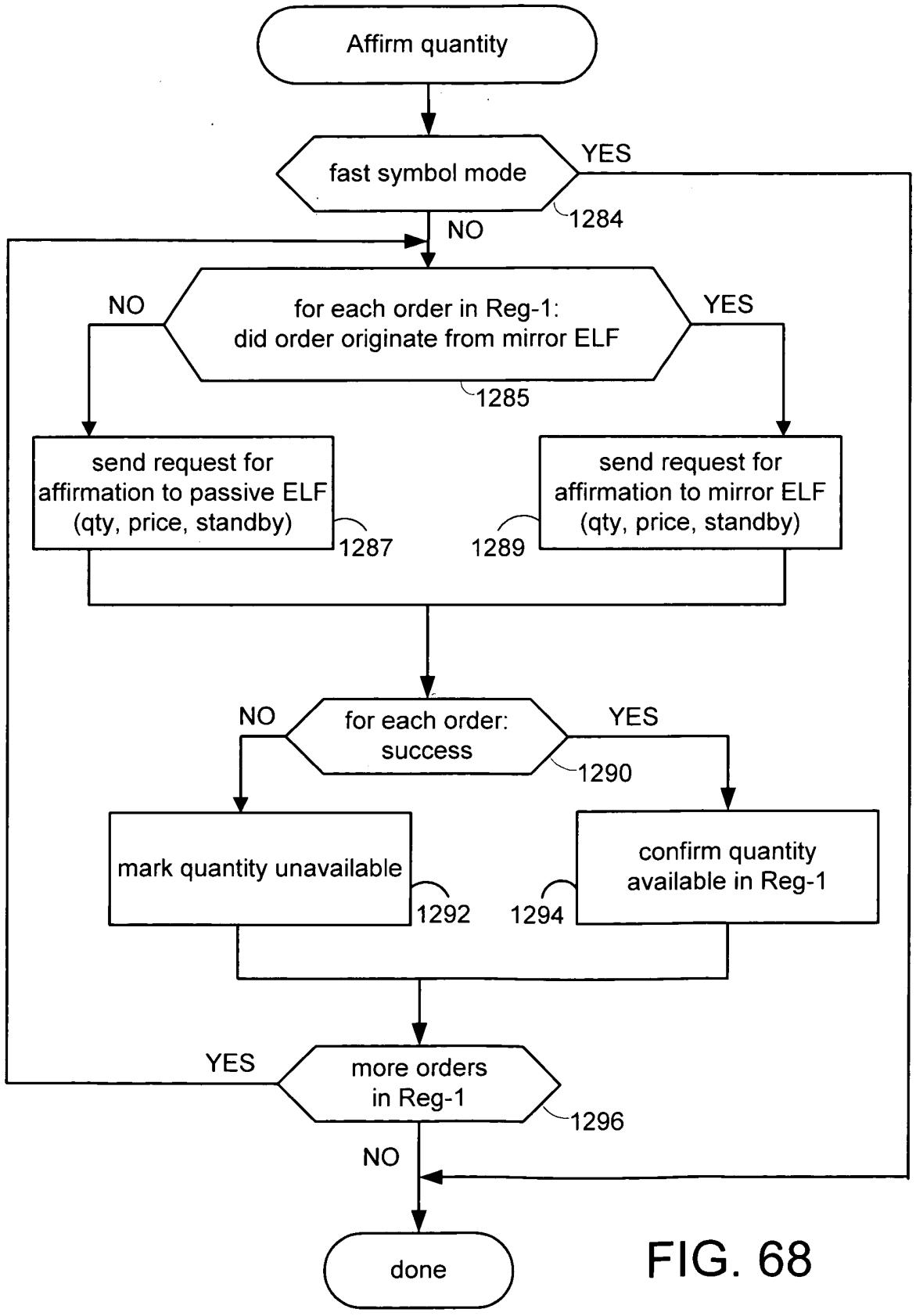

Affirm quantity
fast symbol mode
YES
1284
NO
NO
for each order in Reg-1:
did order originate from mirror ELF
YES
1285
send request for
affirmation to passive ELF
(qty, price, standby)
1287
send request for
affirmation to mirror ELF
(qty, price, standby)
1289
NO
for each order:
success
YES
1290
mark quantity unavailable
1292
confirm quantity
available in Reg-1
1294
YES
more orders
in Reg-1
1296
NO
done

FIG. 68

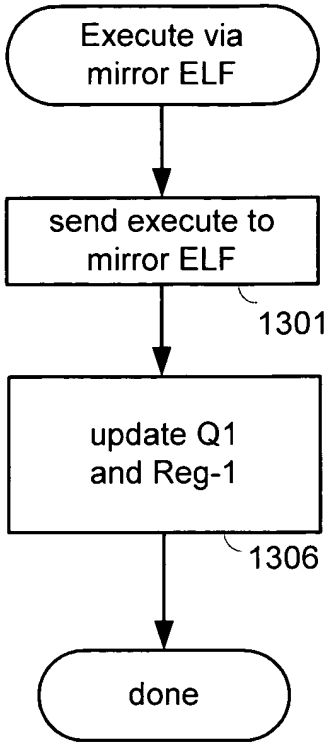

Execute via mirror ELF
send execute to mirror ELF
1301
update Q1 and Reg-1
1306
done

FIG. 69

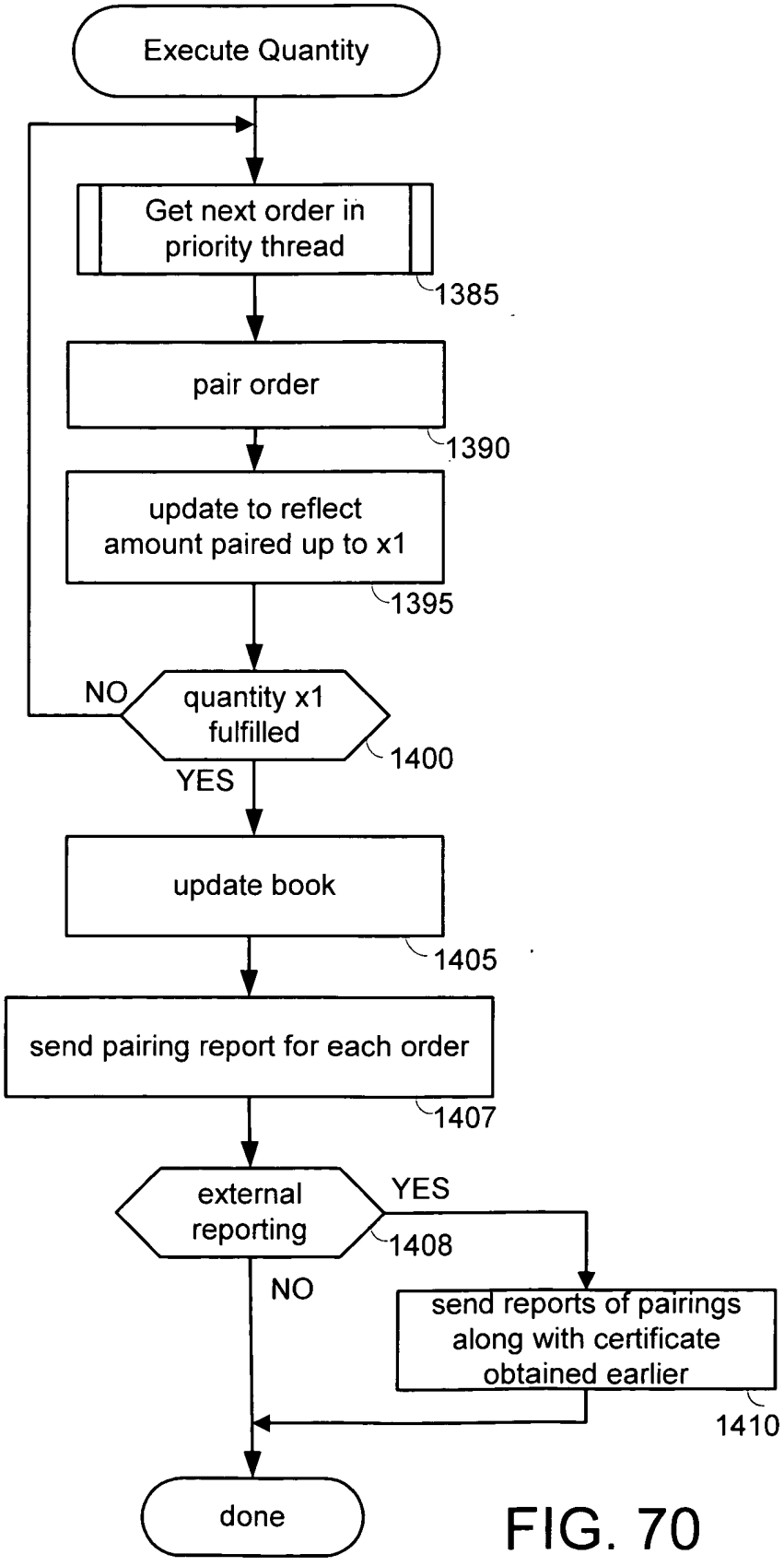

Execute Quantity
Get next order in priority thread
1385
pair order
1390
update to reflect amount paired up to x1
1395
NO
quantity x1 fulfilled
1400
YES
update book
1405
send pairing report for each order
1407
external reporting
YES
1408
NO
send reports of pairings along with certificate obtained earlier
1410
done

FIG. 70

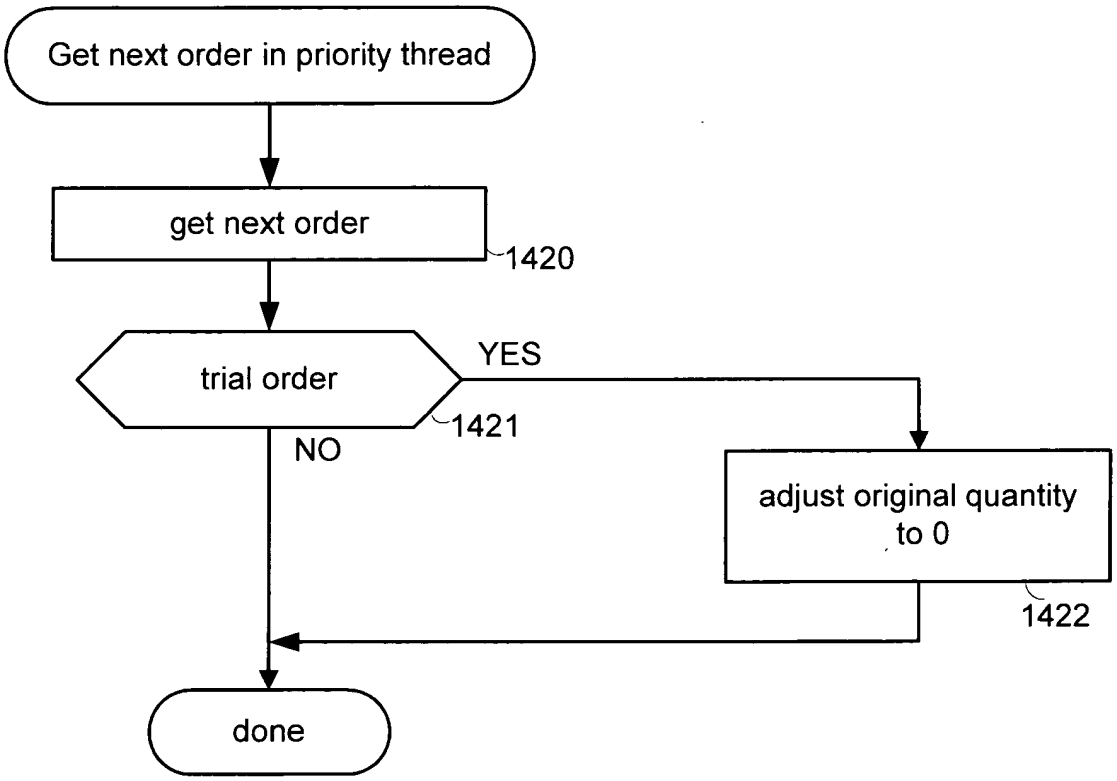

Get next order in priority thread
get next order
1420
trial order
YES
1421
NO
adjust original quantity to 0
1422
done

FIG. 71

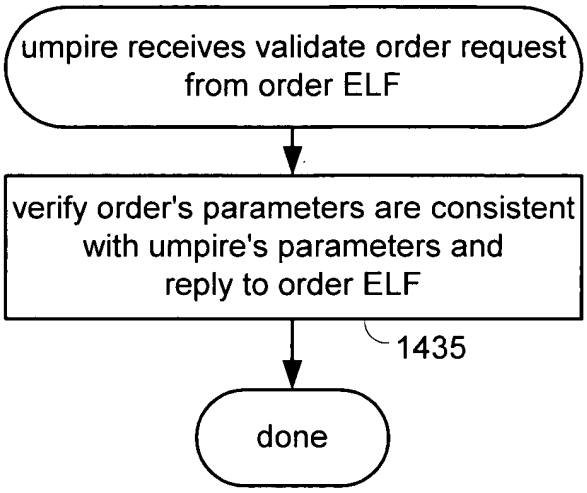

umpire receives validate order request from order ELF
verify order's parameters are consistent with umpire's parameters and reply to order ELF
1435
done

FIG. 72

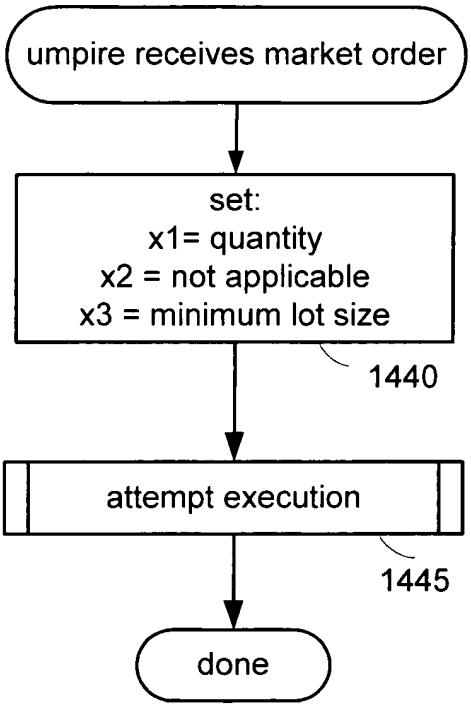

umpire receives market order
set:
x1= quantity
x2 = not applicable
x3 = minimum lot size
1440
attempt execution
1445
done

FIG. 73

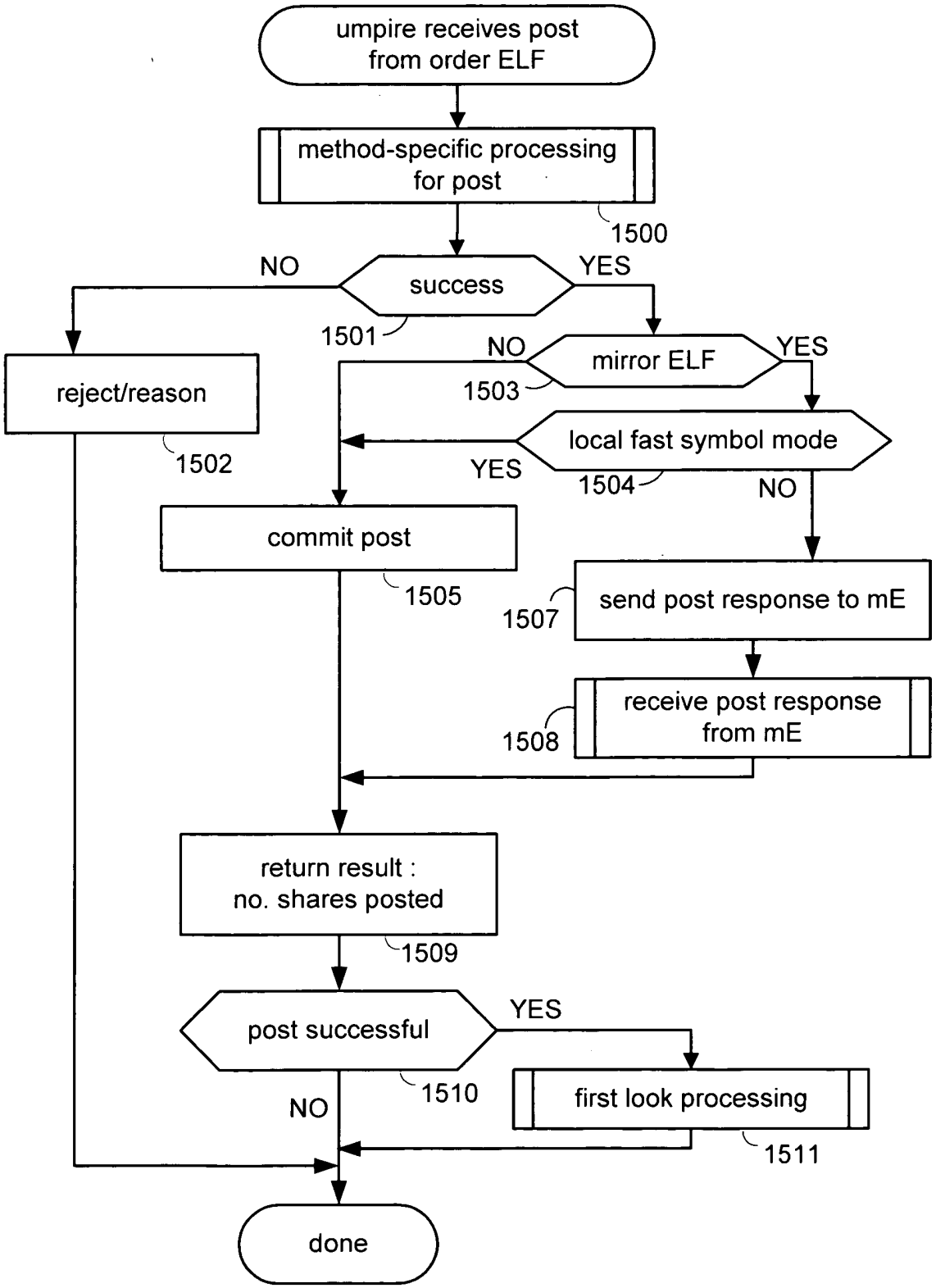

umpire receives post from order ELF
method-specific processing for post
1500
success
NO
YES
1501
reject/reason
1502
mirror ELF
NO
YES
1503
local fast symbol mode
YES
1504
NO
commit post
1505
send post response to mE
1507
receive post response from mE
1508
return result : no. shares posted
1509
post successful
YES
1510
NO
first look processing
1511
done

FIG. 74

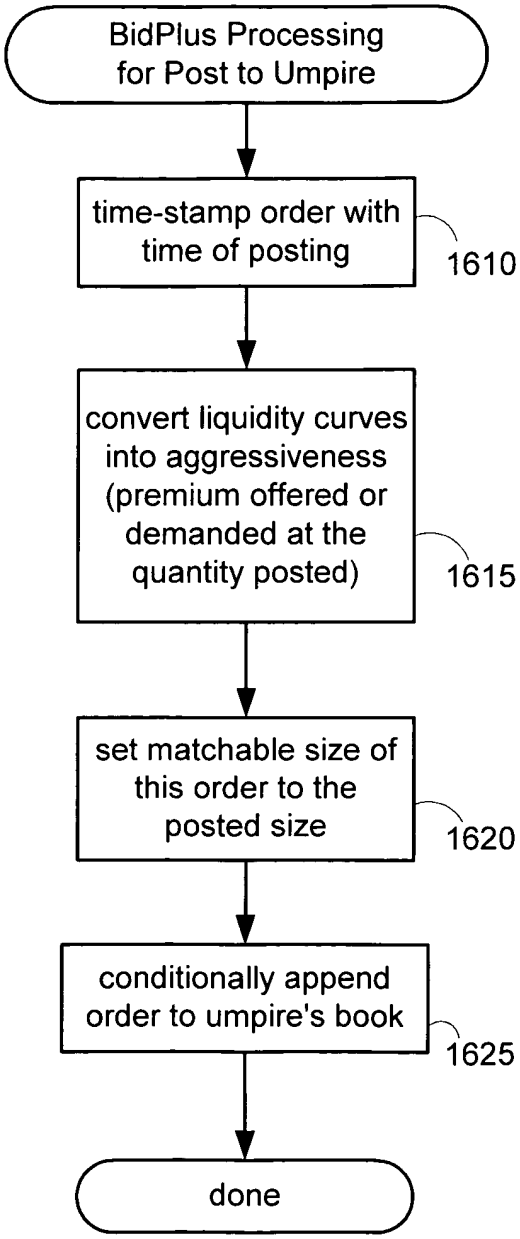

BidPlus Processing for Post to Umpire
time-stamp order with time of posting
1610
convert liquidity curves into aggressiveness (premium offered or demanded at the quantity posted)
1615
set matchable size of this order to the posted size
1620
conditionally append order to umpire's book
1625
done

FIG. 75

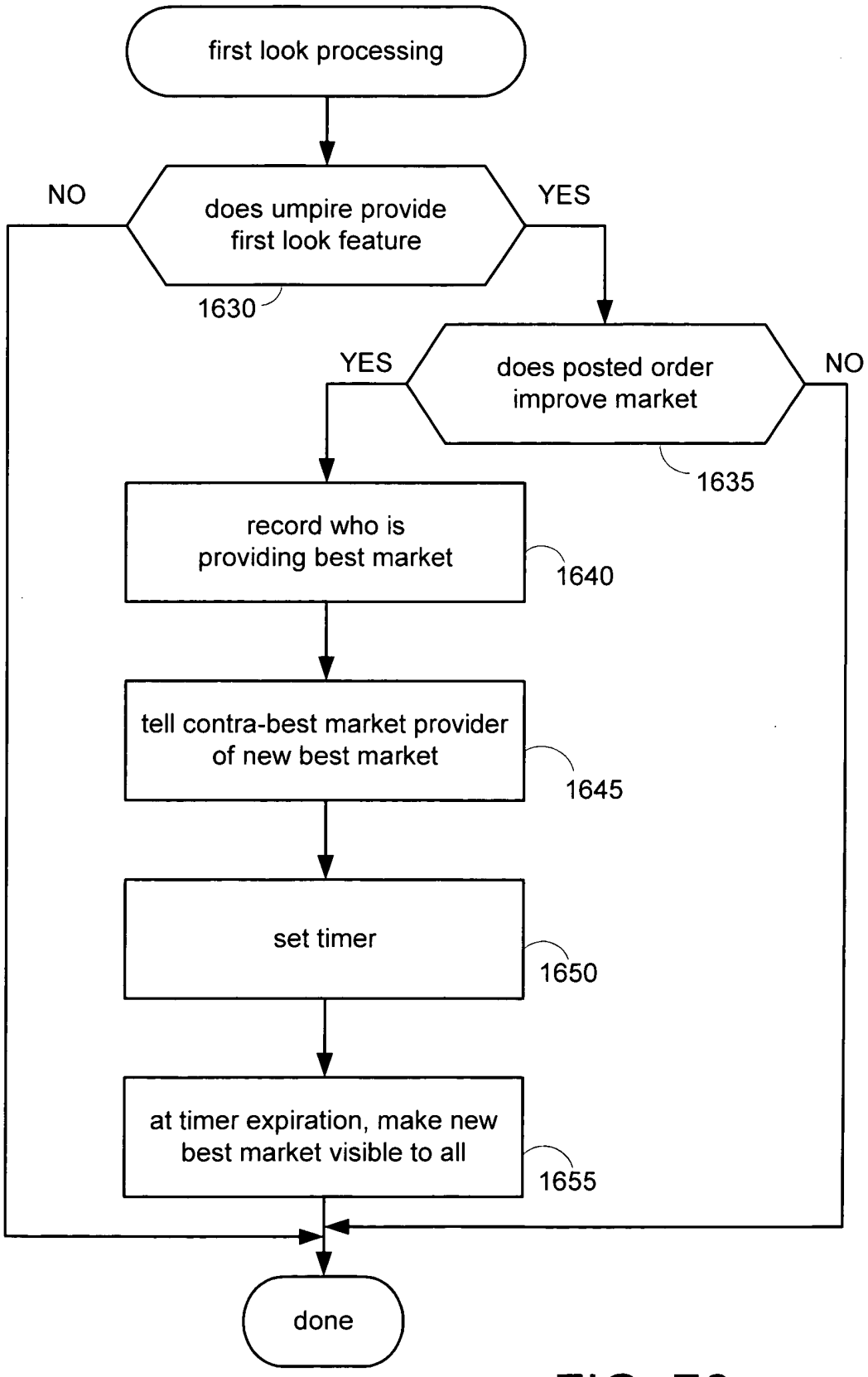

first look processing
does umpire provide first look feature
NO
YES
1630
does posted order improve market
YES
NO
1635
record who is providing best market
1640
tell contra-best market provider of new best market
1645
set timer
1650
at timer expiration, make new best market visible to all
1655
done

FIG. 76

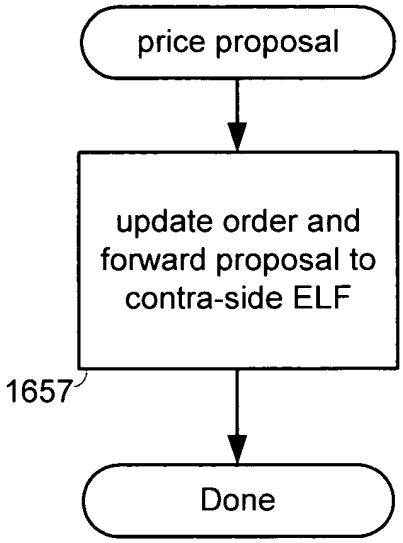


FIG. 77

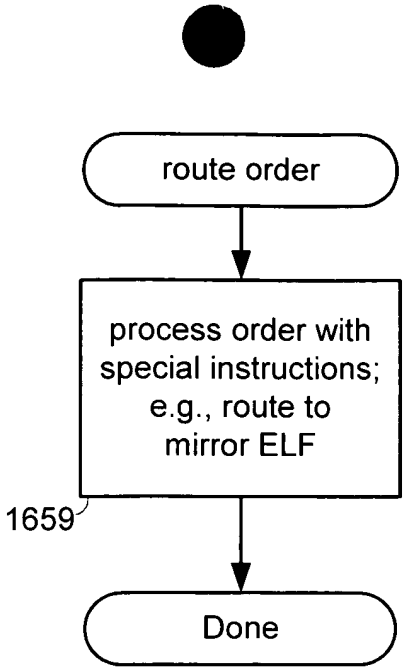


FIG. 78

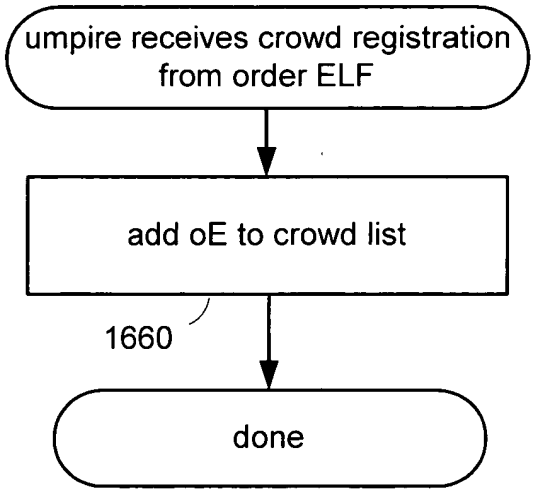


FIG. 79

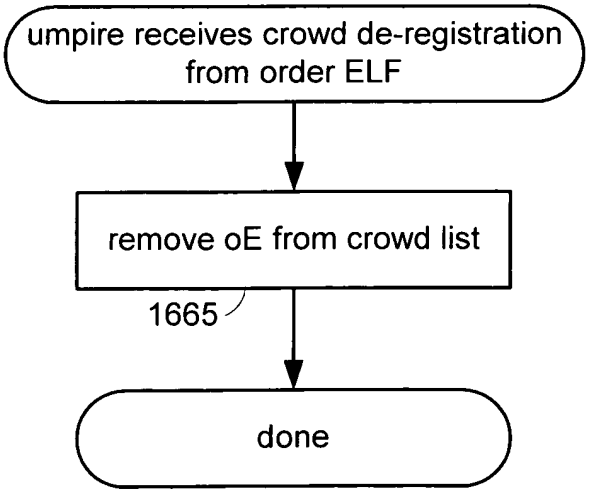


FIG. 80

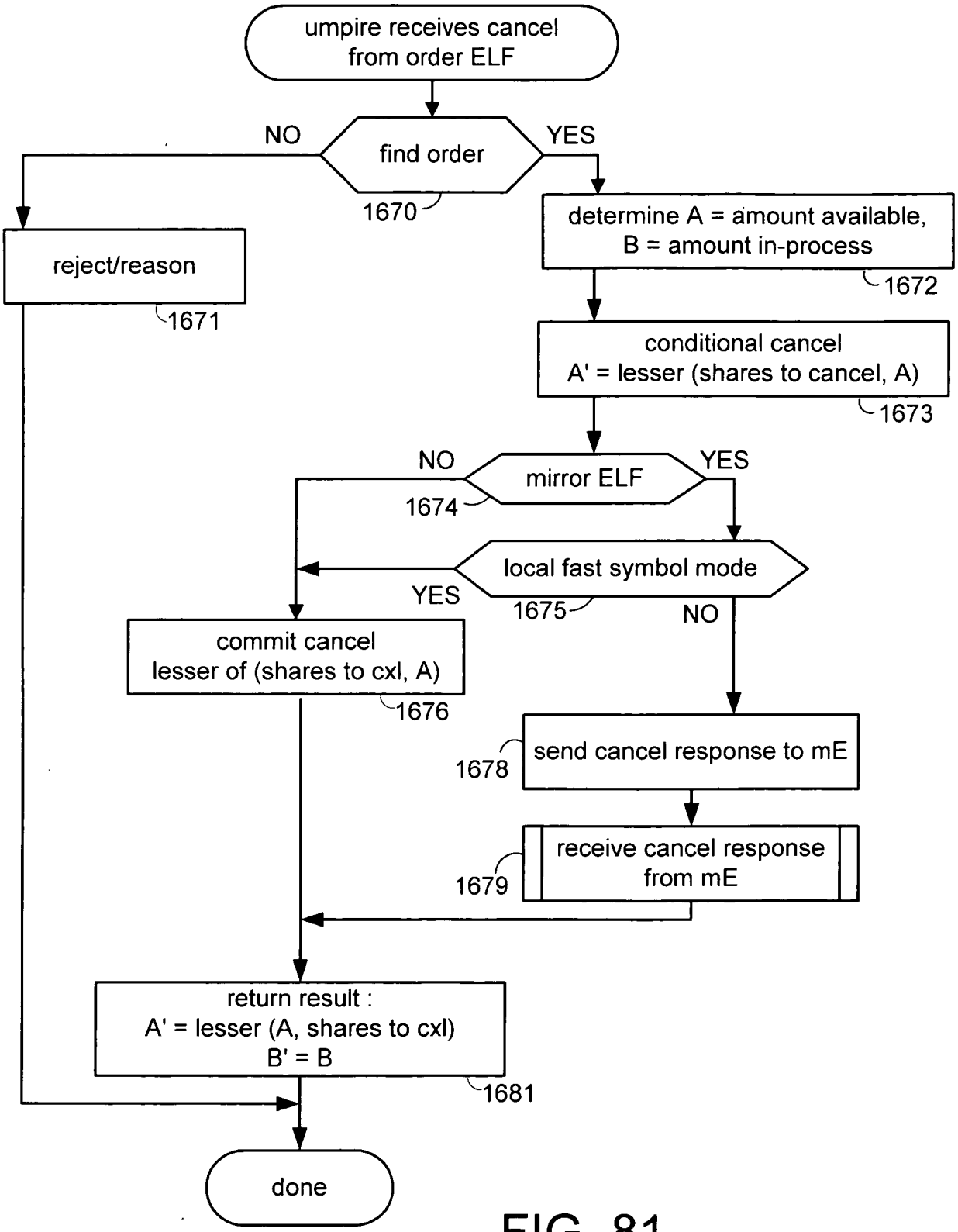

umpire receives cancel from order ELF
find order
NO
YES
1670
reject/reason
1671
determine A = amount available, B = amount in-process
1672
conditional cancel A' = lesser (shares to cancel, A)
1673
mirror ELF
NO
YES
1674
local fast symbol mode
YES
NO
1675
commit cancel lesser of (shares to cxl, A)
1676
send cancel response to mE
1678
receive cancel response from mE
1679
return result : A' = lesser (A, shares to cxl) B' = B
1681
done

FIG. 81

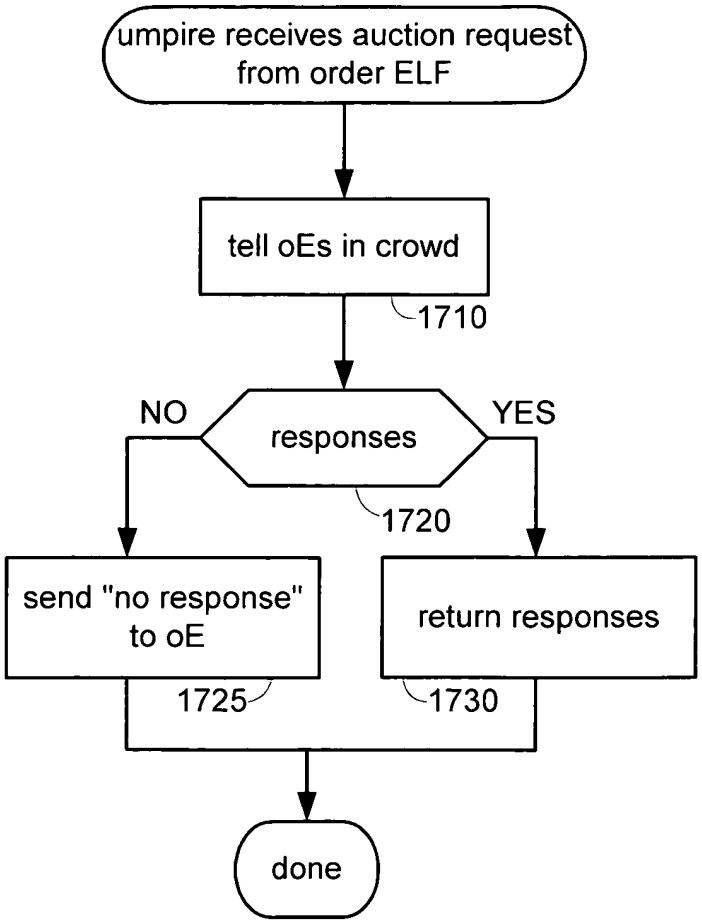

umpire receives auction request from order ELF
tell oEs in crowd
1710
NO
responses
YES
1720
send "no response" to oE
return responses
1725
1730
done

FIG. 82

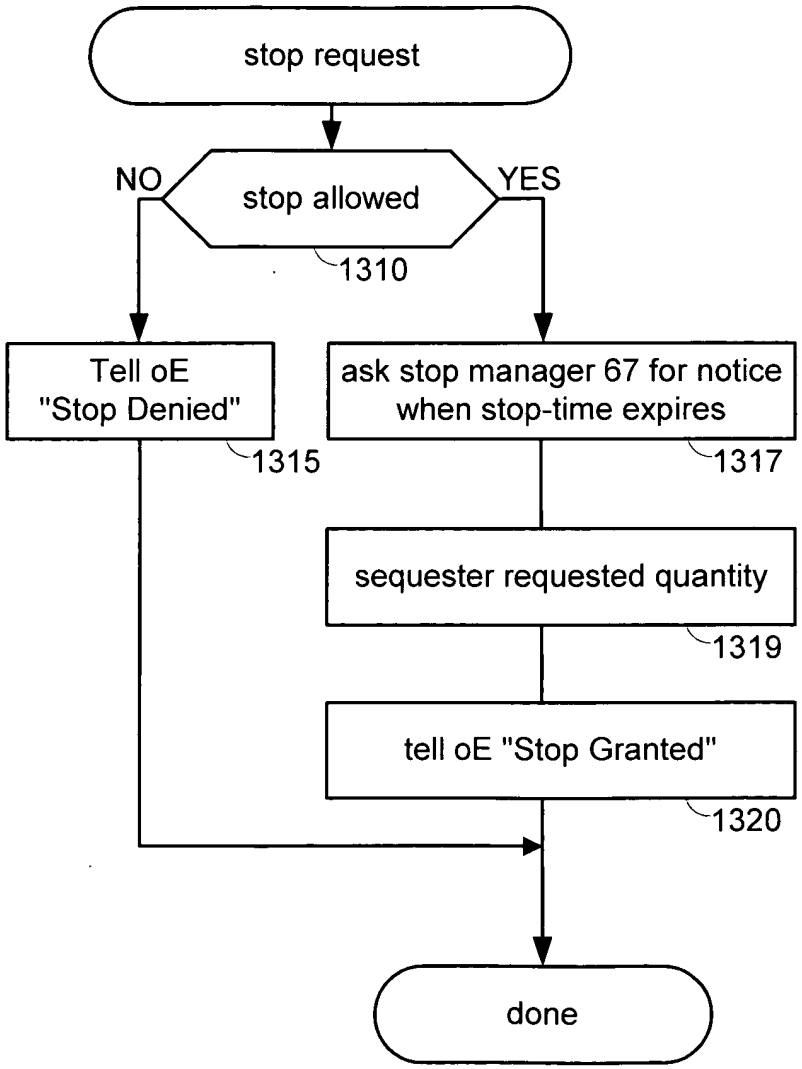

stop request
NO
stop allowed
YES
1310
Tell oE
"Stop Denied"
1315
ask stop manager 67 for notice
when stop-time expires
1317
sequester requested quantity
1319
tell oE "Stop Granted"
1320
done

FIG. 83

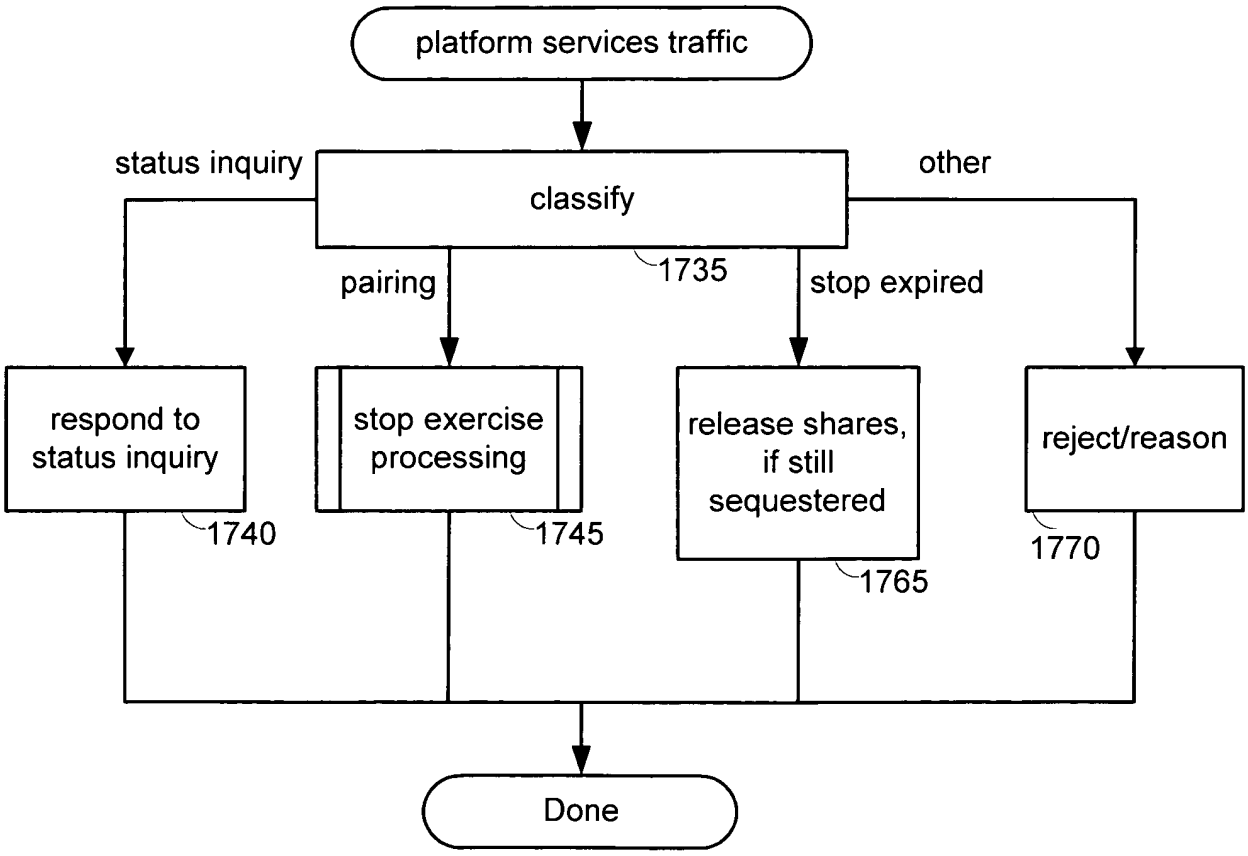

platform services traffic
classify
1735
status inquiry
pairing
stop expired
other
respond to status inquiry
1740
stop exercise processing
1745
release shares, if still sequestered
1765
reject/reason
1770
Done

FIG. 84

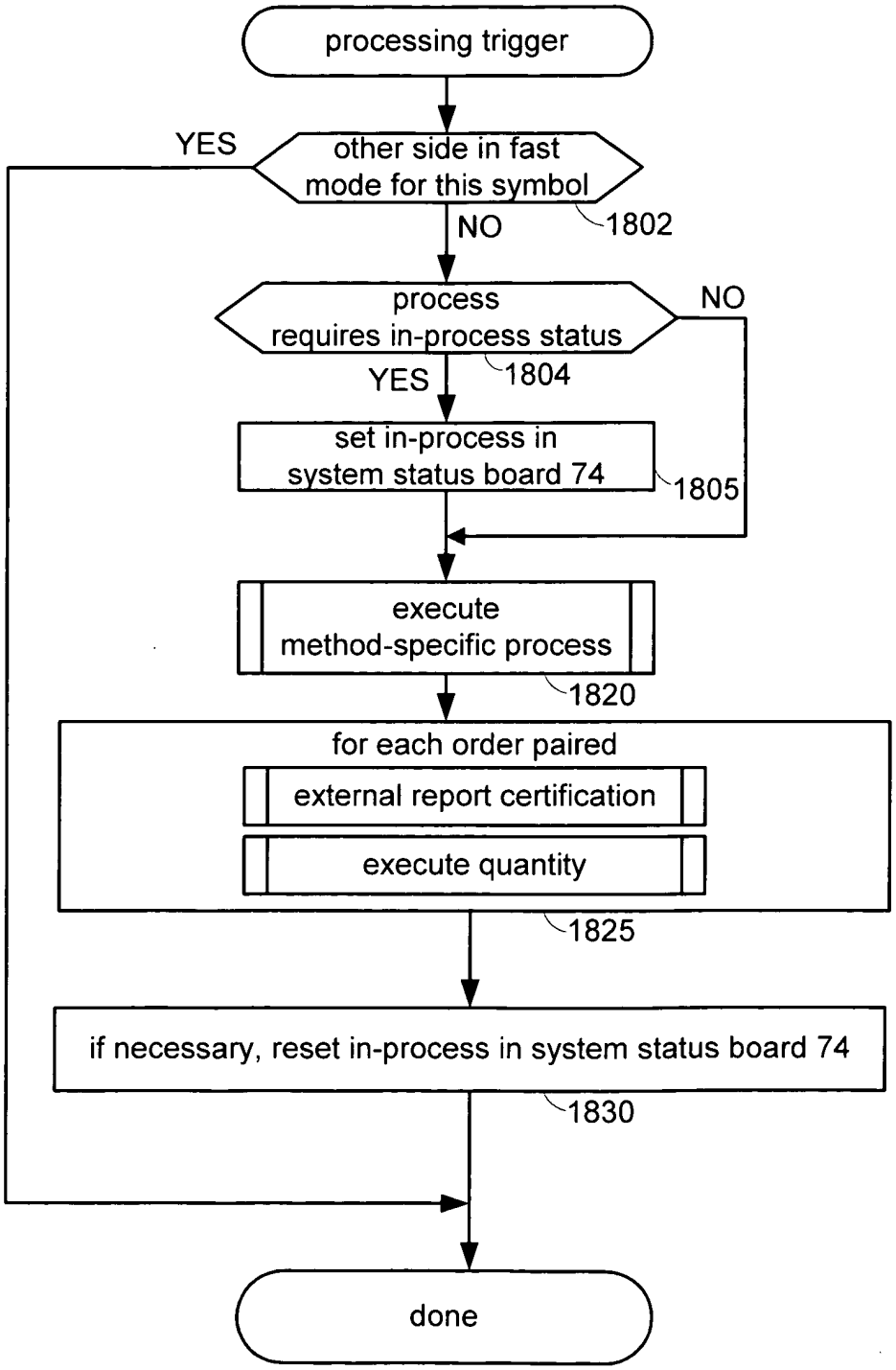

processing trigger
YES
other side in fast mode for this symbol
1802
NO
process requires in-process status
NO
YES
1804
set in-process in system status board 74
1805
execute method-specific process
1820
for each order paired
external report certification
execute quantity
1825
if necessary, reset in-process in system status board 74
1830
done

FIG. 85

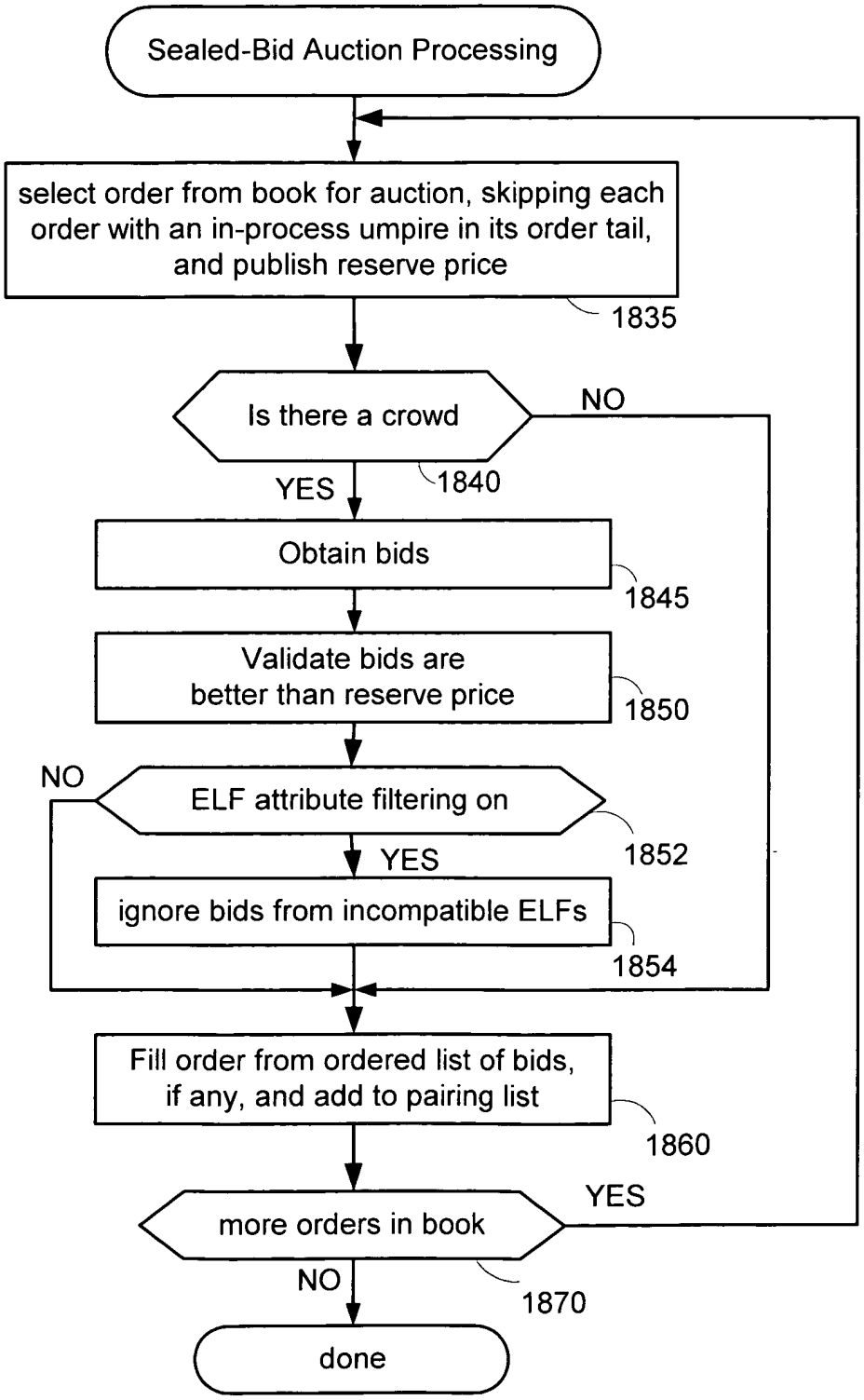

Sealed-Bid Auction Processing
select order from book for auction, skipping each order with an in-process umpire in its order tail, and publish reserve price
1835
Is there a crowd
NO
YES
1840
Obtain bids
1845
Validate bids are better than reserve price
1850
NO
ELF attribute filtering on
1852
YES
ignore bids from incompatible ELFs
1854
Fill order from ordered list of bids, if any, and add to pairing list
1860
more orders in book
YES
NO
1870
done

FIG. 86

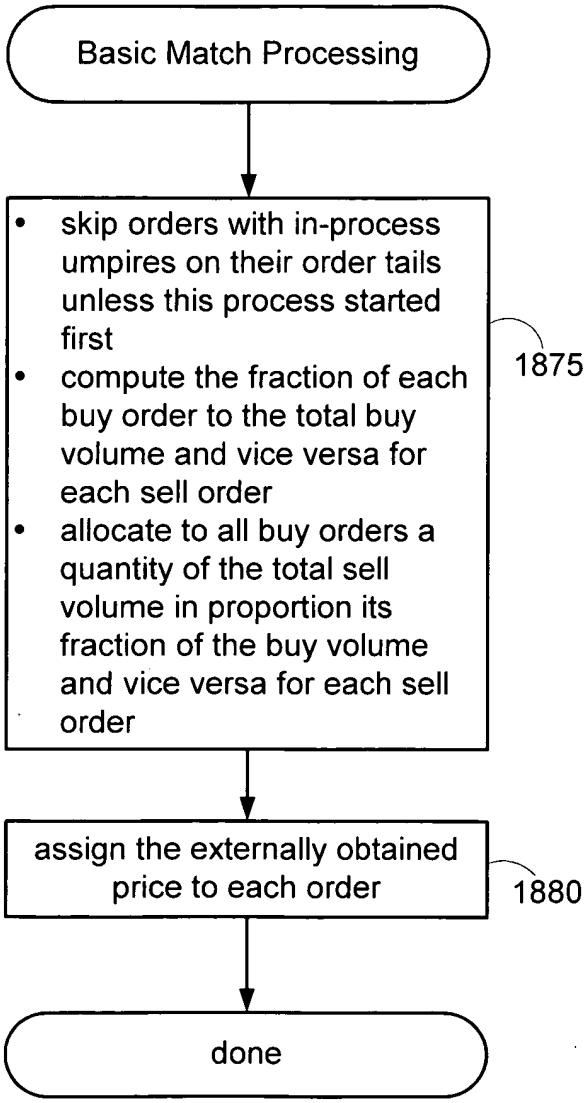

Basic Match Processing
• skip orders with in-process umpires on their order tails unless this process started first
• compute the fraction of each buy order to the total buy volume and vice versa for each sell order
• allocate to all buy orders a quantity of the total sell volume in proportion its fraction of the buy volume and vice versa for each sell order
1875
assign the externally obtained price to each order
1880
done

FIG. 87

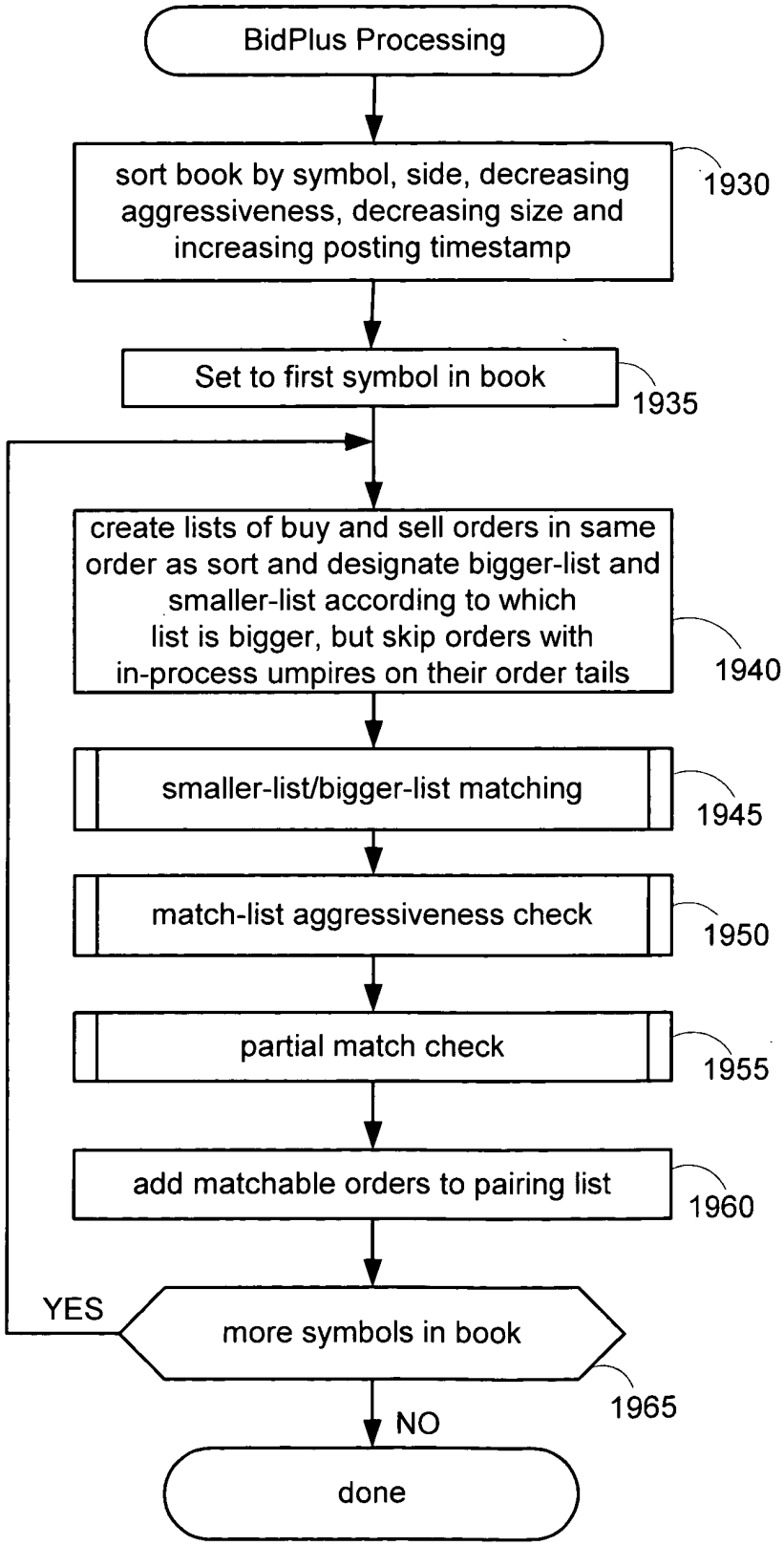

BidPlus Processing
sort book by symbol, side, decreasing aggressiveness, decreasing size and increasing posting timestamp
1930
Set to first symbol in book
1935
create lists of buy and sell orders in same order as sort and designate bigger-list and smaller-list according to which list is bigger, but skip orders with in-process umpires on their order tails
1940
smaller-list/bigger-list matching
1945
match-list aggressiveness check
1950
partial match check
1955
add matchable orders to pairing list
1960
YES
more symbols in book
1965
NO
done

FIG. 88

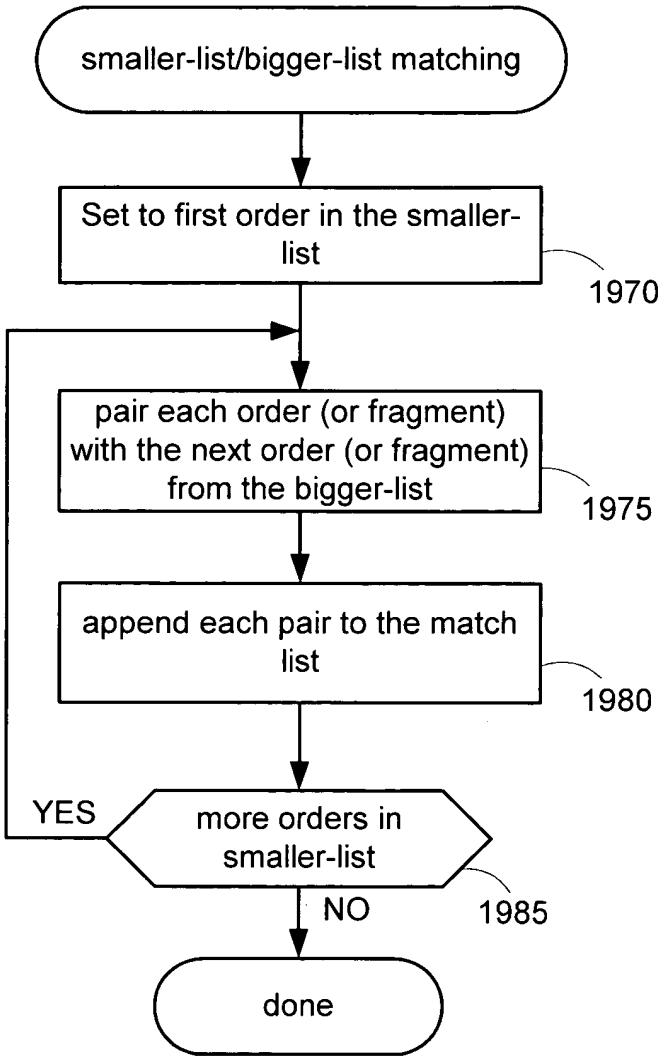

smaller-list/bigger-list matching
Set to first order in the smaller-list
1970
pair each order (or fragment) with the next order (or fragment) from the bigger-list
1975
append each pair to the match list
1980
YES
more orders in smaller-list
1985
NO
done

FIG. 89

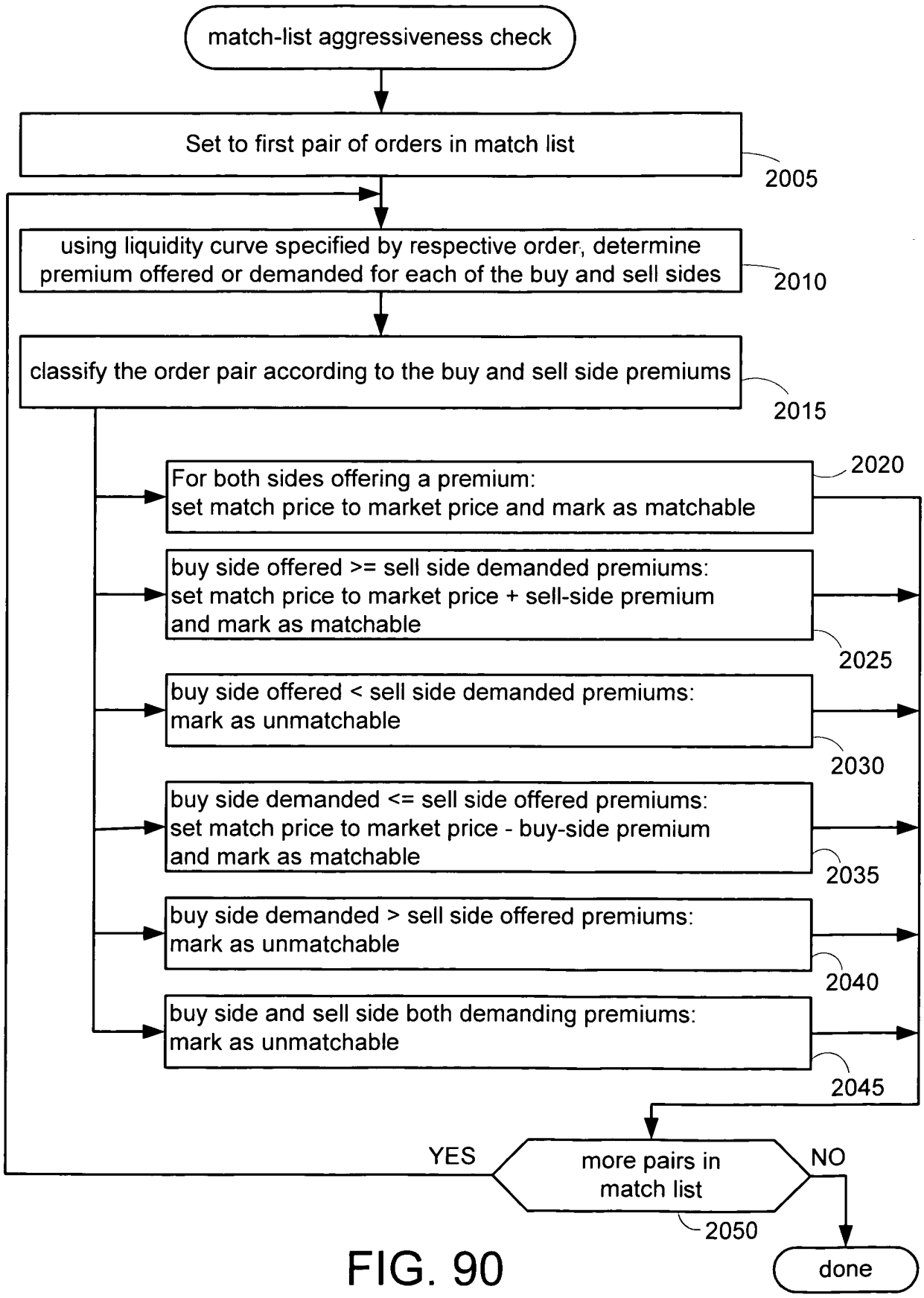

match-list aggressiveness check
Set to first pair of orders in match list
2005
using liquidity curve specified by respective order, determine premium offered or demanded for each of the buy and sell sides
2010
classify the order pair according to the buy and sell side premiums
2015
For both sides offering a premium: set match price to market price and mark as matchable
2020
buy side offered >= sell side demanded premiums: set match price to market price + sell-side premium and mark as matchable
2025
buy side offered < sell side demanded premiums: mark as unmatchable
2030
buy side demanded <= sell side offered premiums: set match price to market price - buy-side premium and mark as matchable
2035
buy side demanded > sell side offered premiums: mark as unmatchable
2040
buy side and sell side both demanding premiums: mark as unmatchable
2045
YES
more pairs in match list
NO
2050
done

FIG. 90

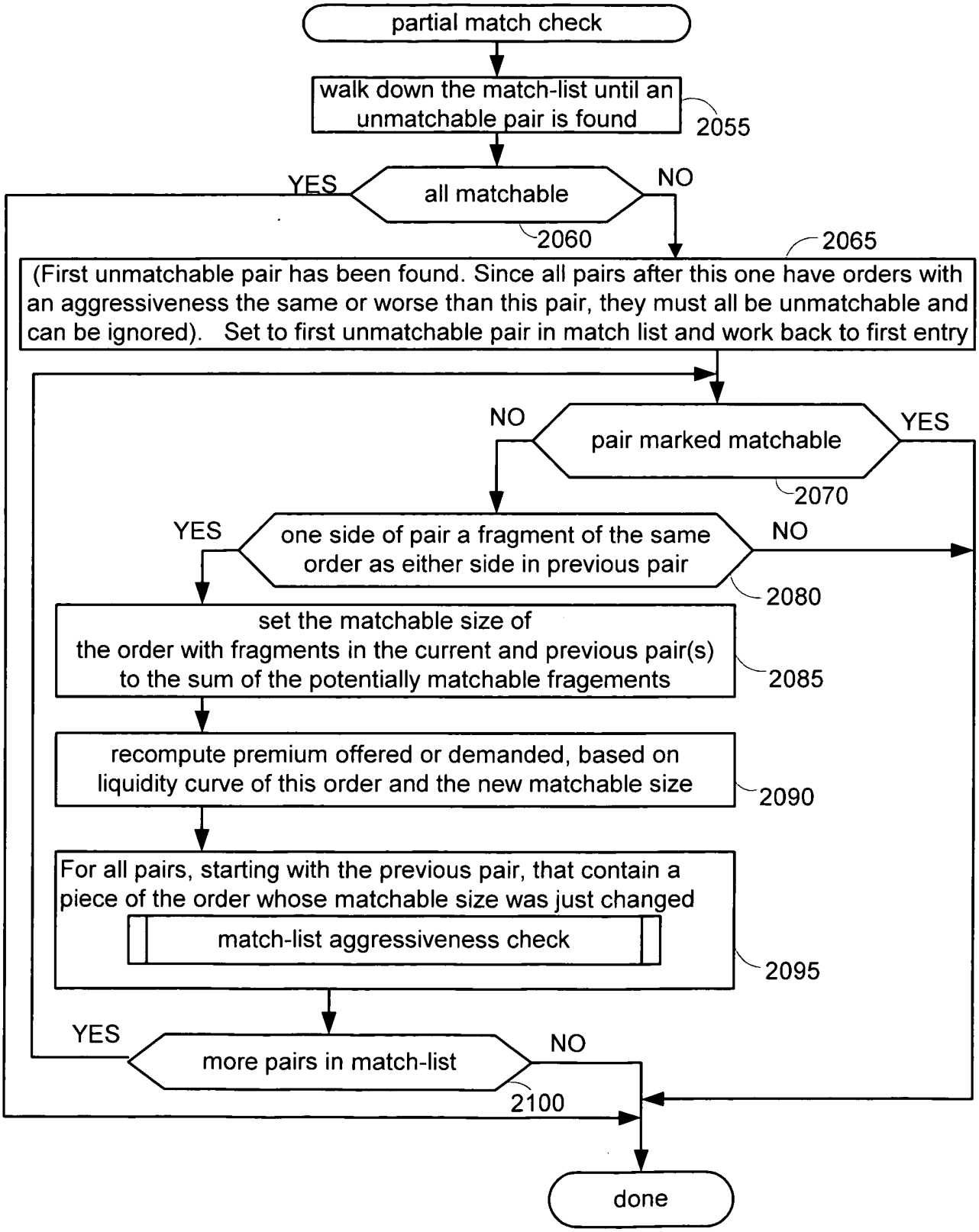

partial match check
walk down the match-list until an unmatchable pair is found
2055
YES
all matchable
NO
2060
2065
(First unmatchable pair has been found. Since all pairs after this one have orders with an aggressiveness the same or worse than this pair, they must all be unmatchable and can be ignored). Set to first unmatchable pair in match list and work back to first entry
NO
pair marked matchable
YES
2070
YES
one side of pair a fragment of the same order as either side in previous pair
NO
2080
set the matchable size of the order with fragments in the current and previous pair(s) to the sum of the potentially matchable fragements
2085
recompute premium offered or demanded, based on liquidity curve of this order and the new matchable size
2090
For all pairs, starting with the previous pair, that contain a piece of the order whose matchable size was just changed
match-list aggressiveness check
2095
YES
more pairs in match-list
NO
2100
done

FIG. 91

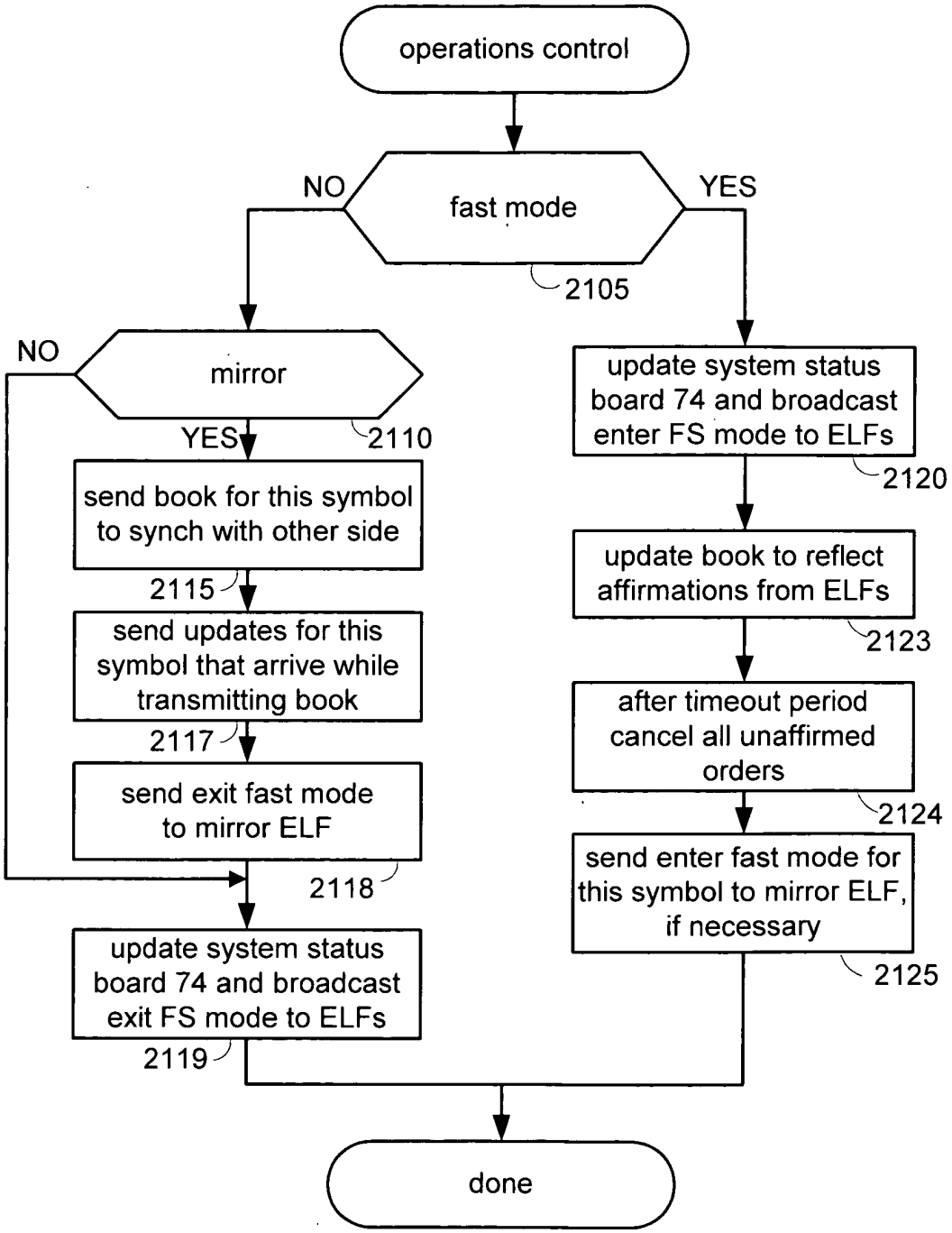

operations control
fast mode
NO
YES
2105
mirror
NO
YES
2110
send book for this symbol to synch with other side
2115
send updates for this symbol that arrive while transmitting book
2117
send exit fast mode to mirror ELF
2118
update system status board 74 and broadcast exit FS mode to ELFs
2119
update system status board 74 and broadcast enter FS mode to ELFs
2120
update book to reflect affirmations from ELFs
2123
after timeout period cancel all unaffirmed orders
2124
send enter fast mode for this symbol to mirror ELF, if necessary
2125
done

FIG. 92

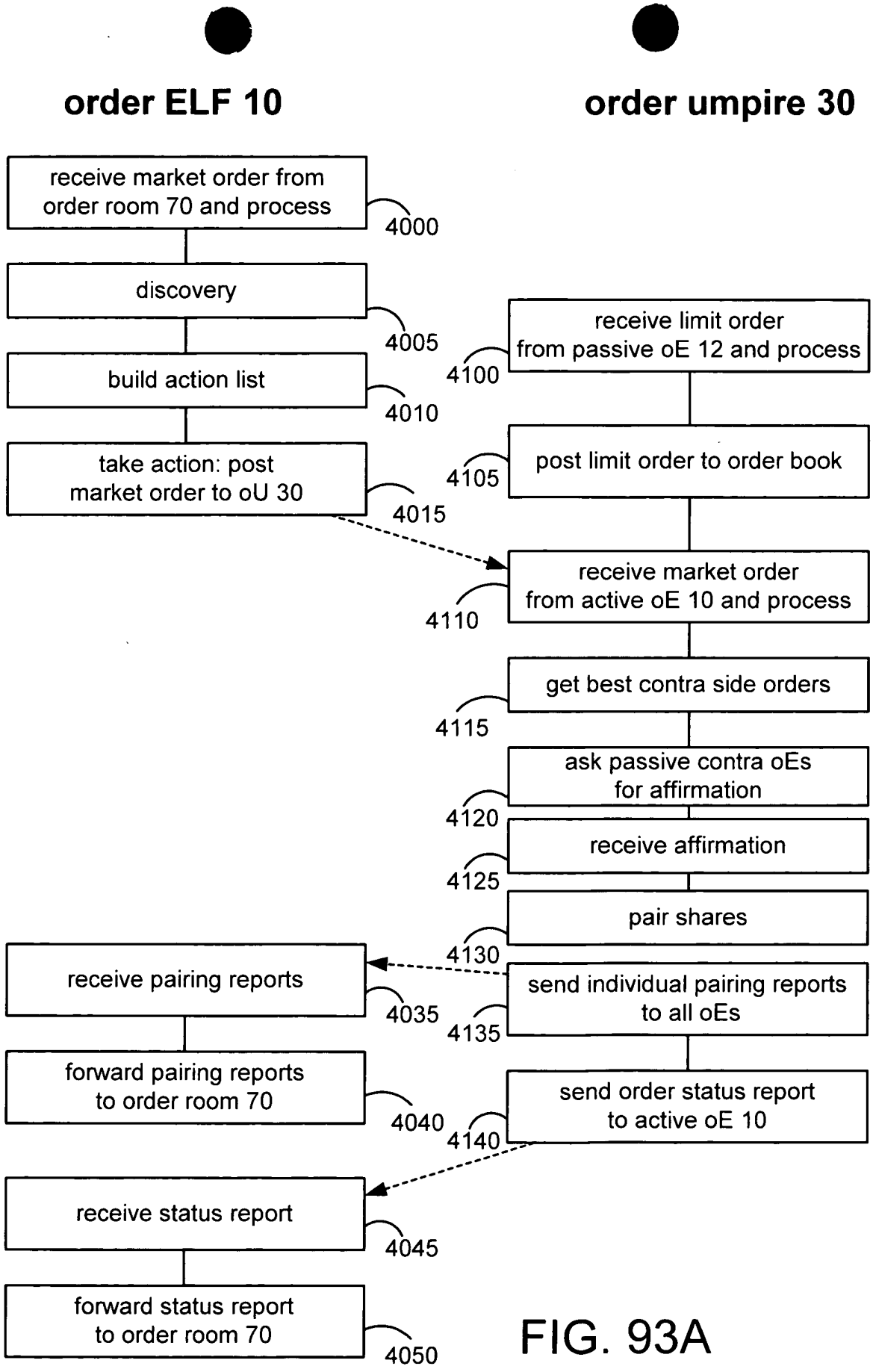

order ELF 10
order umpire 30
receive market order from order room 70 and process
4000
discovery
4005
build action list
4010
take action: post market order to oU 30
4015
receive limit order from passive oE 12 and process
4100
post limit order to order book
4105
receive market order from active oE 10 and process
4110
get best contra side orders
4115
ask passive contra oEs for affirmation
4120
receive affirmation
4125
pair shares
4130
send individual pairing reports to all oEs
4135
send order status report to active oE 10
4140
receive pairing reports
4035
forward pairing reports to order room 70
4040
receive status report
4045
forward status report to order room 70
4050

FIG. 93A

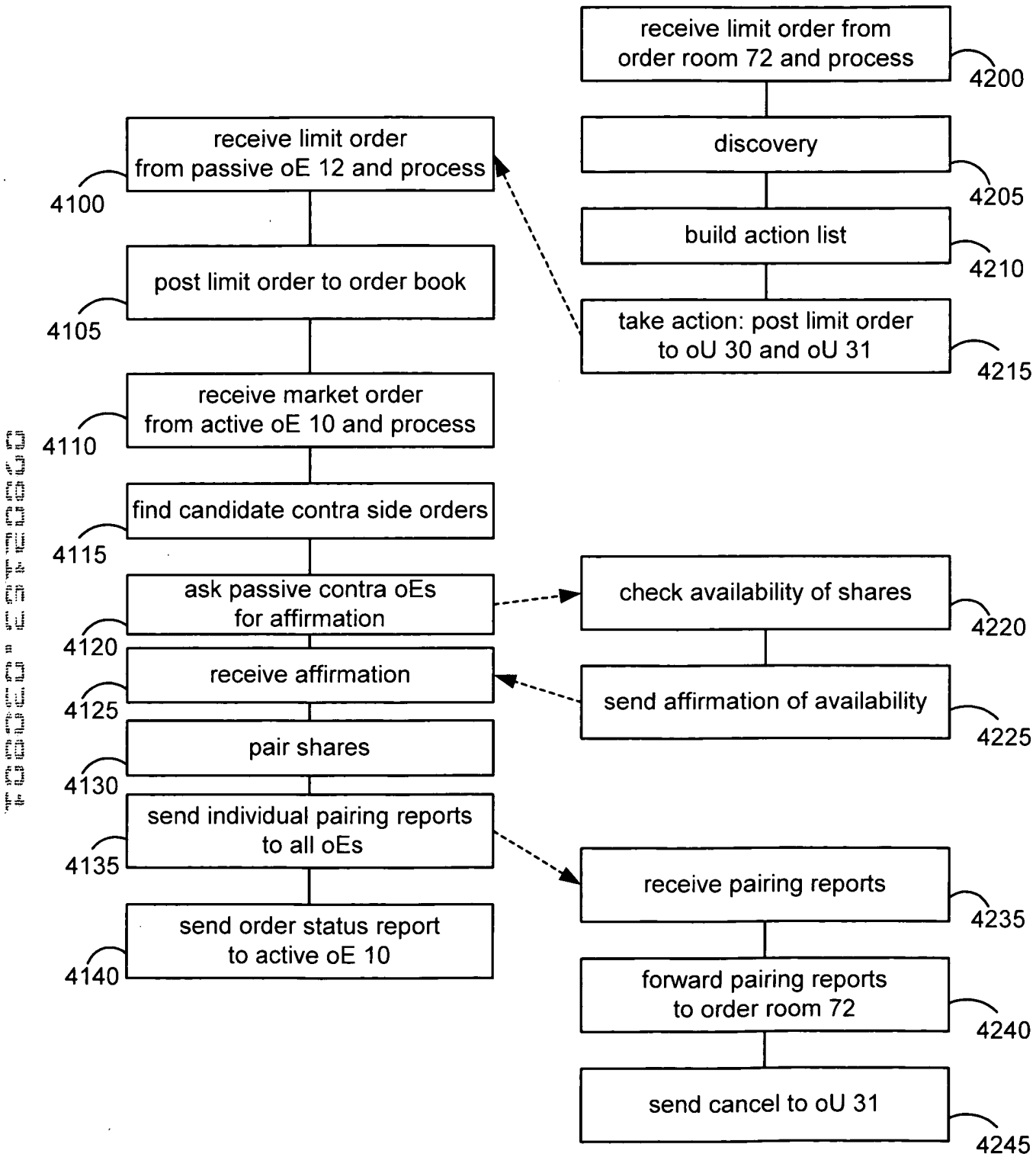

order umpire 30
order ELF 12
receive limit order from order room 72 and process
4200
discovery
4205
build action list
4210
take action: post limit order to oU 30 and oU 31
4215
receive limit order from passive oE 12 and process
4100
post limit order to order book
4105
receive market order from active oE 10 and process
4110
find candidate contra side orders
4115
ask passive contra oEs for affirmation
4120
check availability of shares
4220
receive affirmation
4125
send affirmation of availability
4225
pair shares
4130
send individual pairing reports to all oEs
4135
receive pairing reports
4235
forward pairing reports to order room 72
4240
send order status report to active oE 10
4140
send cancel to oU 31
4245

FIG. 93B

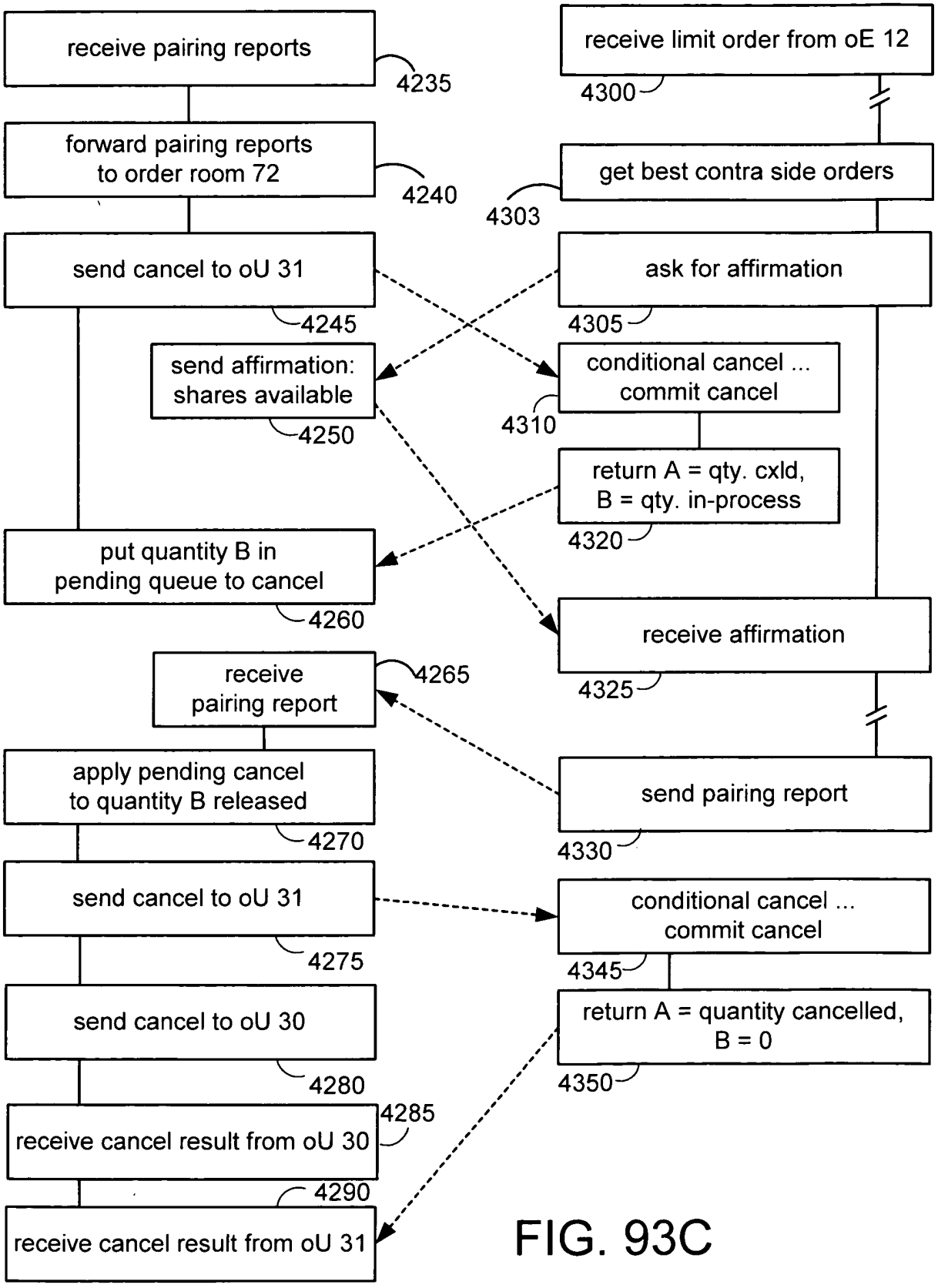

order ELF 12
order umpire 31
receive pairing reports
4235
forward pairing reports to order room 72
4240
send cancel to oU 31
4245
send affirmation: shares available
4250
put quantity B in pending queue to cancel
4260
receive pairing report
4265
apply pending cancel to quantity B released
4270
send cancel to oU 31
4275
send cancel to oU 30
4280
receive cancel result from oU 30
4285
4290
receive cancel result from oU 31
receive limit order from oE 12
4300
get best contra side orders
4303
ask for affirmation
4305
conditional cancel ... commit cancel
4310
return A = qty. cxld, B = qty. in-process
4320
receive affirmation
4325
send pairing report
4330
conditional cancel ... commit cancel
4345
return A = quantity cancelled, B = 0
4350

FIG. 93C

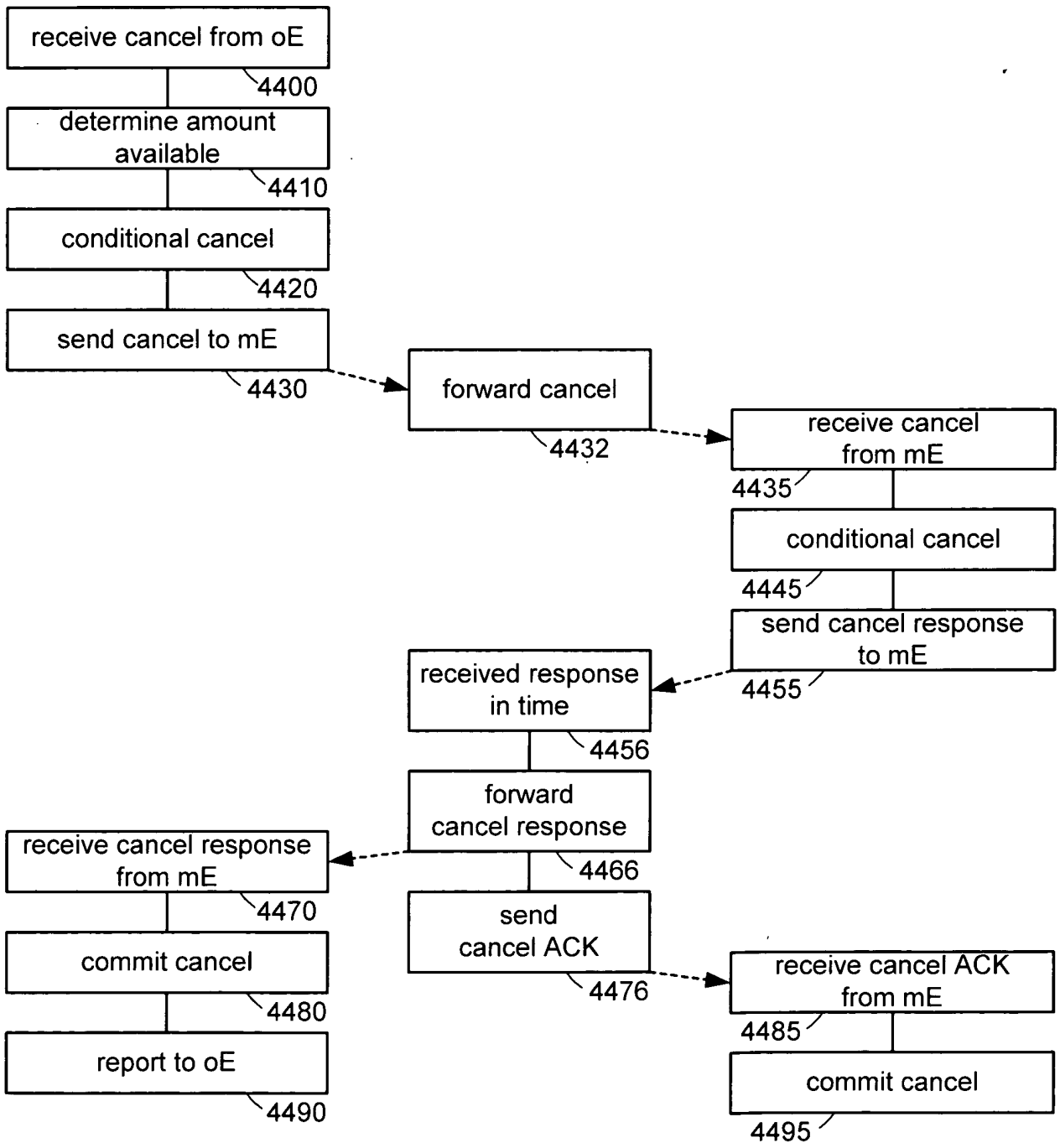

oU 31
mE 51
oU 32
receive cancel from oE
4400
determine amount available
4410
conditional cancel
4420
send cancel to mE
4430
forward cancel
4432
receive cancel from mE
4435
conditional cancel
4445
send cancel response to mE
4455
received response in time
4456
forward cancel response
4466
send cancel ACK
4476
receive cancel response from mE
4470
commit cancel
4480
report to oE
4490
receive cancel ACK from mE
4485
commit cancel
4495

FIG. 94

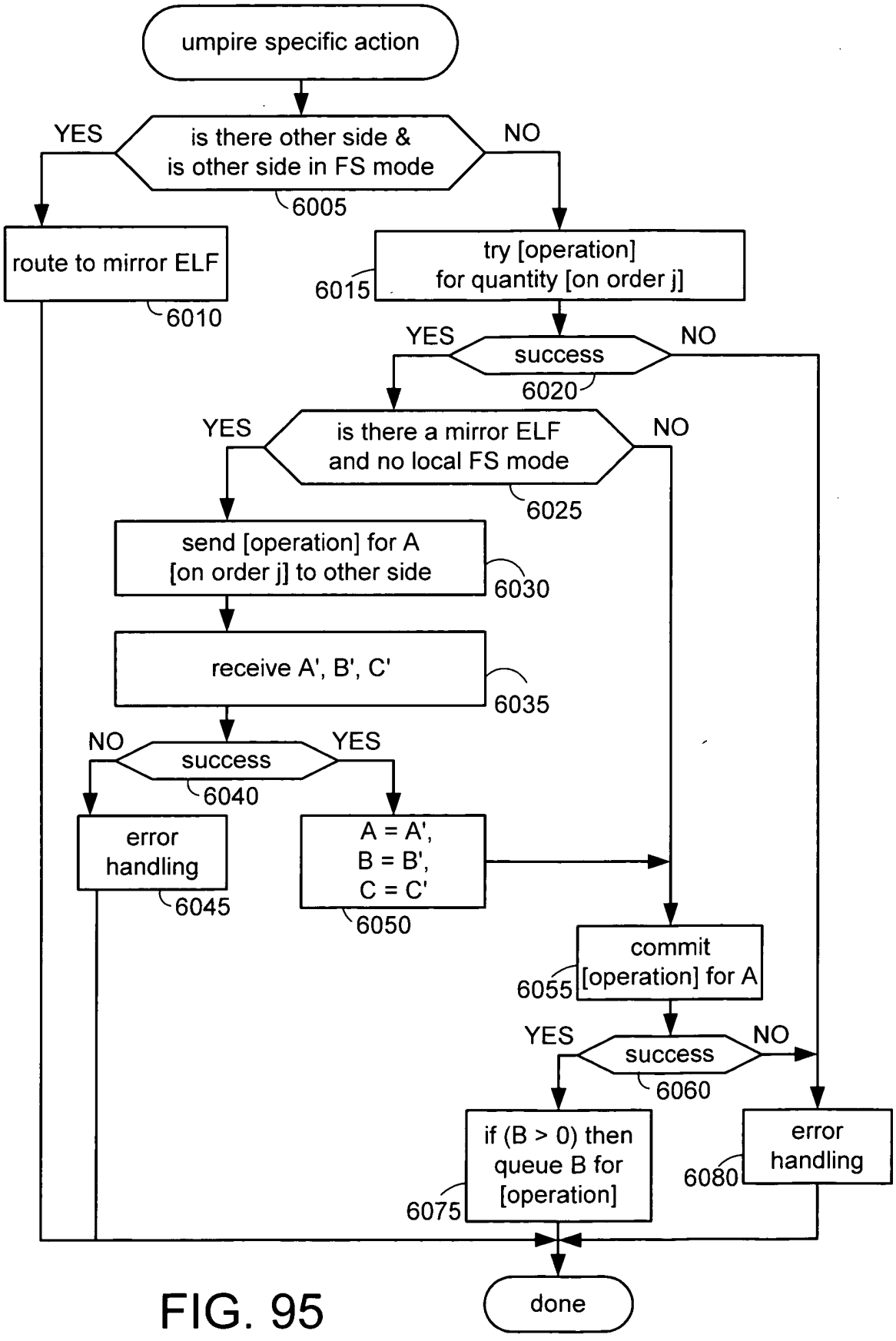

umpire specific action
is there other side & is other side in FS mode
YES
NO
6005
route to mirror ELF
6010
try [operation] for quantity [on order j]
6015
success
YES
NO
6020
is there a mirror ELF and no local FS mode
YES
NO
6025
send [operation] for A [on order j] to other side
6030
receive A', B', C'
6035
success
NO
YES
6040
error handling
6045
A = A', B = B', C = C'
6050
commit [operation] for A
6055
success
YES
NO
6060
if (B > 0) then queue B for [operation]
6075
error handling
6080
done

FIG. 95

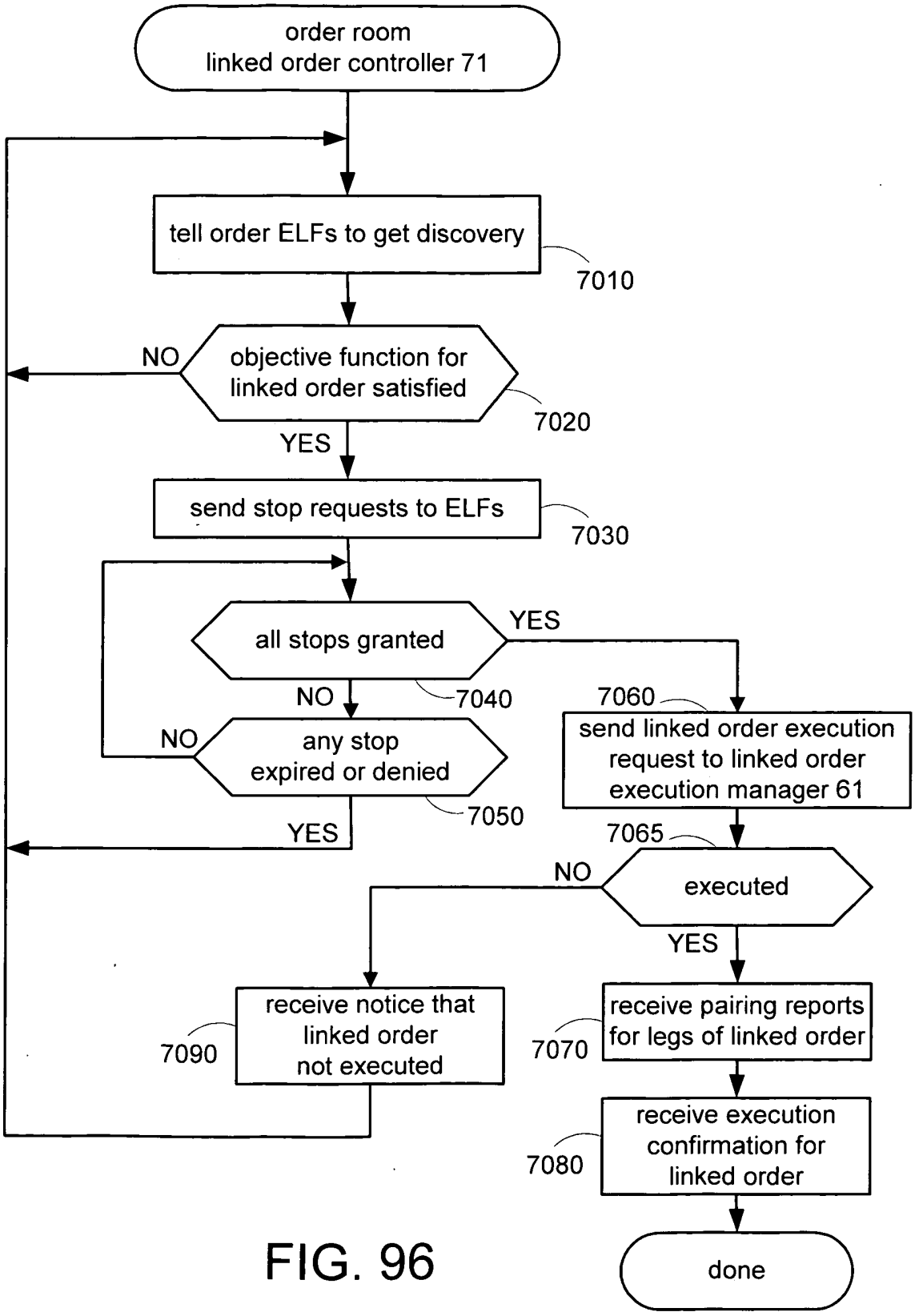

order room
linked order controller 71
tell order ELFs to get discovery
7010
NO
objective function for linked order satisfied
7020
YES
send stop requests to ELFs
7030
all stops granted
YES
NO
7040
7060
send linked order execution request to linked order execution manager 61
NO
any stop expired or denied
7050
YES
7065
NO
executed
YES
receive notice that linked order not executed
7090
receive pairing reports for legs of linked order
7070
receive execution confirmation for linked order
7080
done

FIG. 96

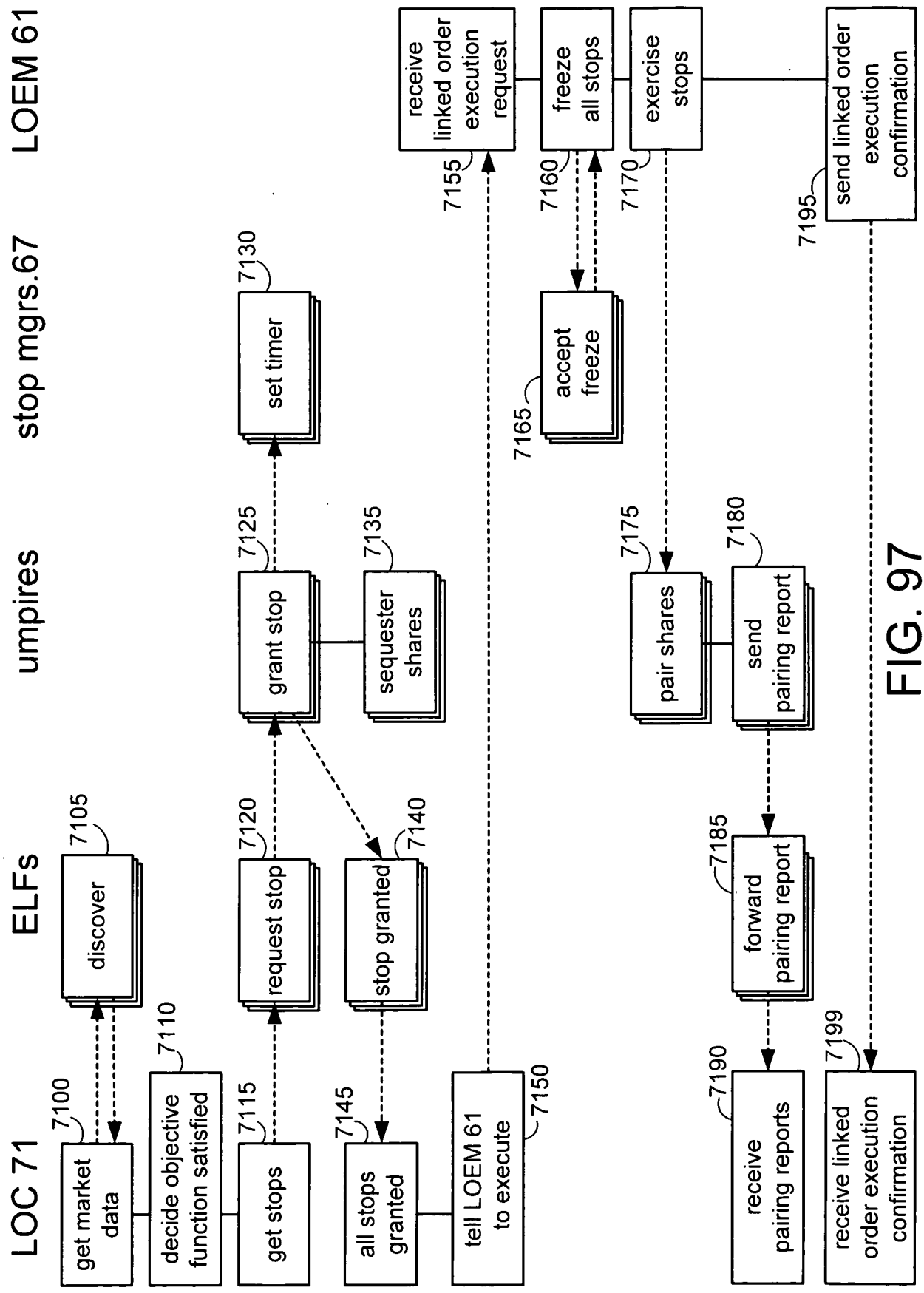

LOC 71
ELFs
umpires
stop mgrs.67
LOEM 61
get market data
7100
discover
7105
decide objective function satisfied
7110
get stops
7115
request stop
7120
grant stop
7125
set timer
7130
sequester shares
7135
all stops granted
7145
stop granted
7140
tell LOEM 61 to execute
7150
receive linked order execution request
7155
freeze all stops
7160
accept freeze
7165
exercise stops
7170
pair shares
7175
send pairing report
7180
forward pairing report
7185
receive pairing reports
7190
send linked order execution confirmation
7195
receive linked order execution confirmation
7199

FIG. 97

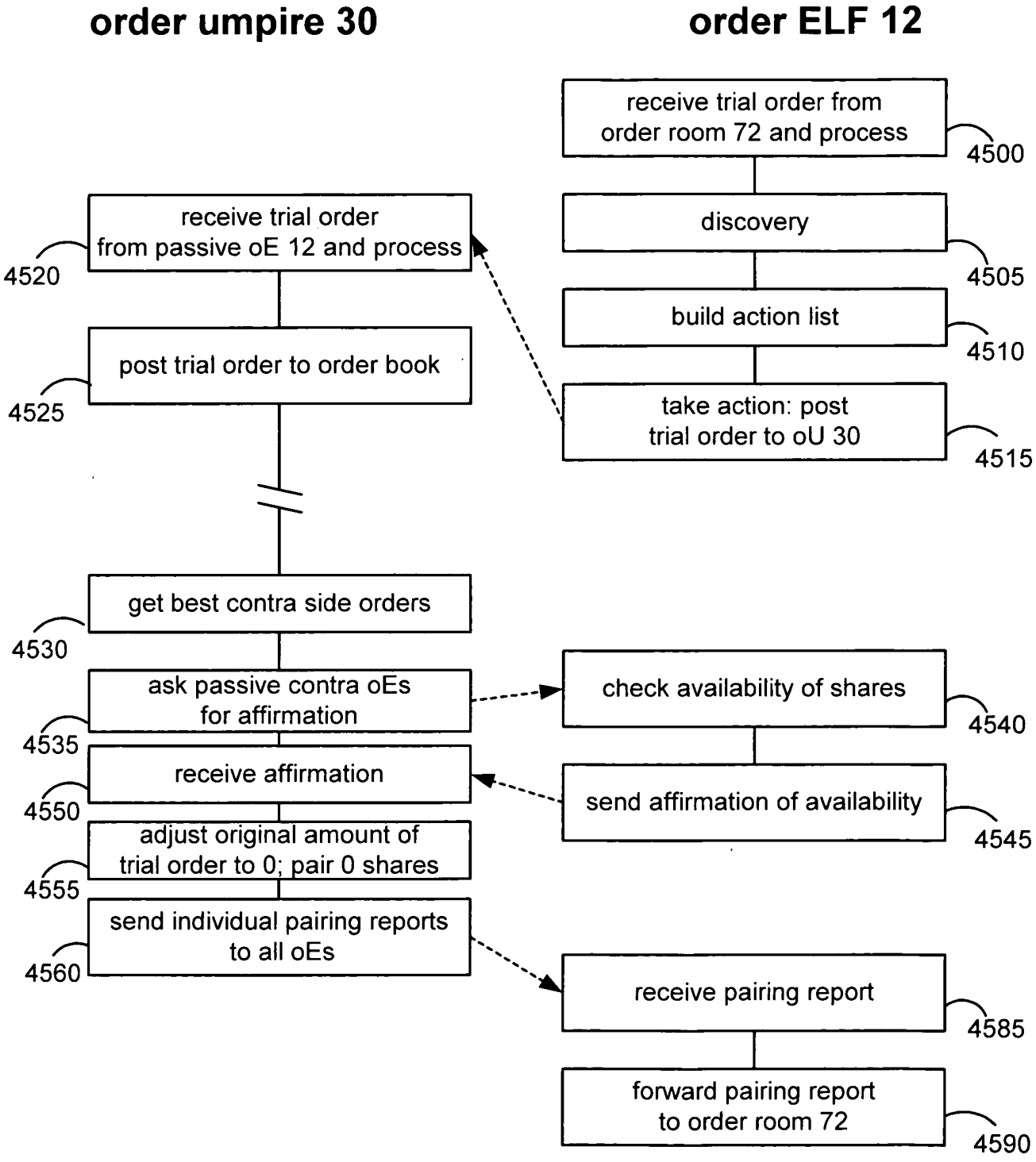

order umpire 30
order ELF 12
receive trial order from order room 72 and process
4500
discovery
4505
build action list
4510
take action: post trial order to oU 30
4515
receive trial order from passive oE 12 and process
4520
post trial order to order book
4525
get best contra side orders
4530
ask passive contra oEs for affirmation
4535
receive affirmation
4550
adjust original amount of trial order to 0; pair 0 shares
4555
send individual pairing reports to all oEs
4560
check availability of shares
4540
send affirmation of availability
4545
receive pairing report
4585
forward pairing report to order room 72
4590

FIG. 98

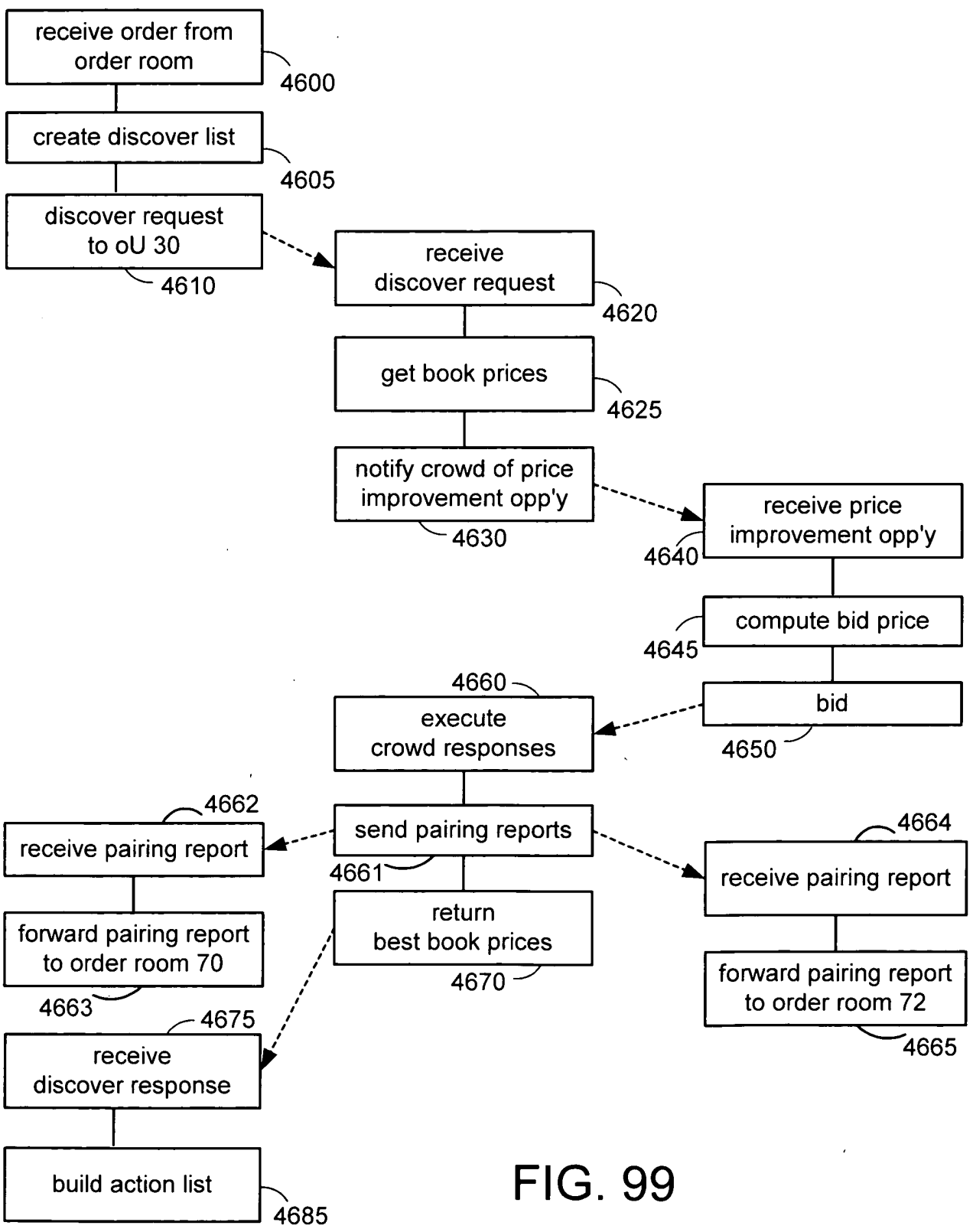

oE 10
oU 30
oE 12
receive order from order room
4600
create discover list
4605
discover request to oU 30
4610
receive discover request
4620
get book prices
4625
notify crowd of price improvement opp'y
4630
receive price improvement opp'y
4640
compute bid price
4645
bid
4650
4660
execute crowd responses
4662
receive pairing report
send pairing reports
4661
4664
receive pairing report
forward pairing report to order room 70
4663
return best book prices
4670
forward pairing report to order room 72
4665
4675
receive discover response
build action list
4685

FIG. 99

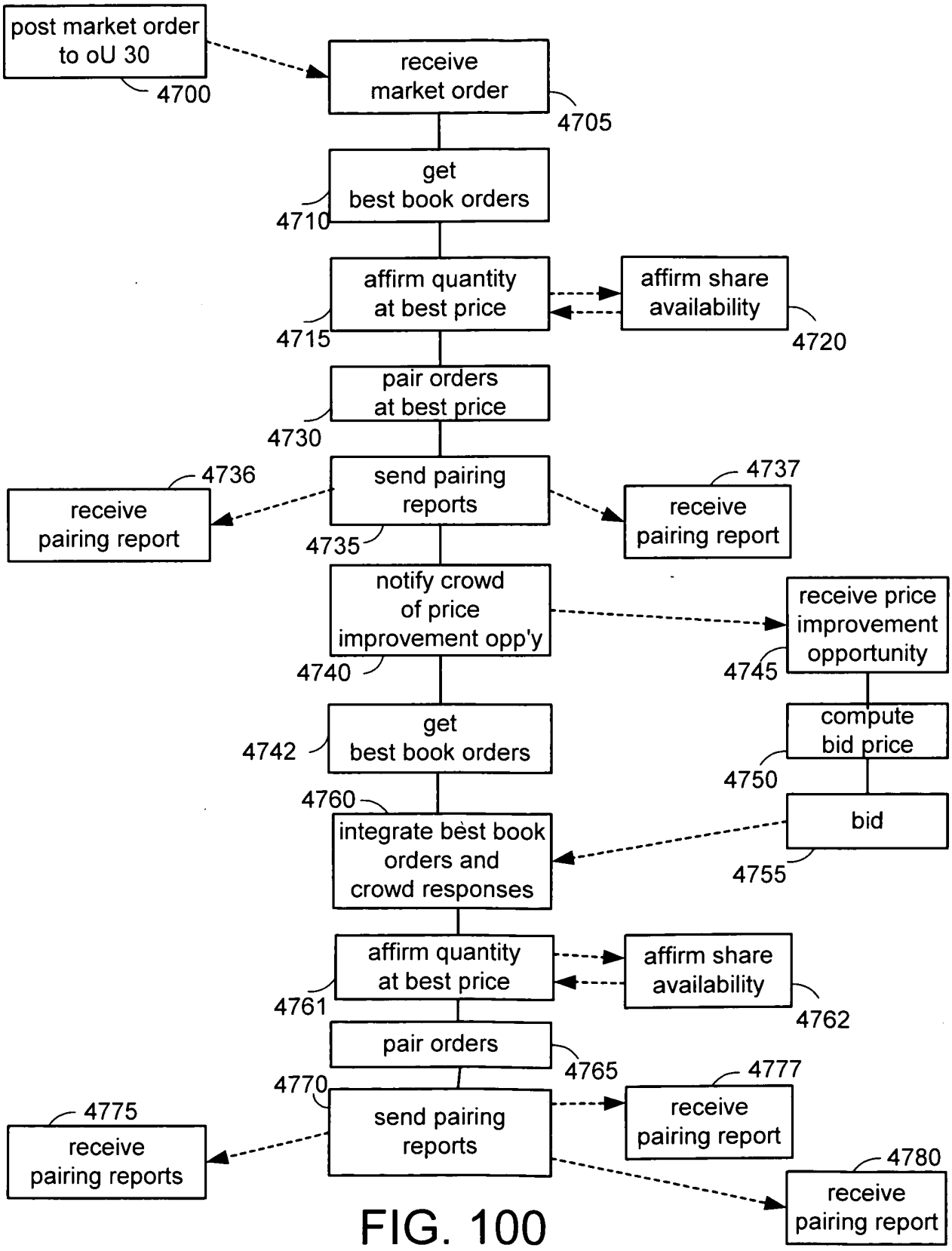

oE 10
oU 30
oE 11
oE 12
post market order to oU 30
4700
receive market order
4705
get best book orders
4710
affirm quantity at best price
4715
affirm share availability
4720
pair orders at best price
4730
send pairing reports
4735
4736
receive pairing report
4737
receive pairing report
notify crowd of price improvement opp'y
4740
receive price improvement opportunity
4745
get best book orders
4742
compute bid price
4750
bid
4755
4760
integrate best book orders and crowd responses
affirm quantity at best price
4761
affirm share availability
4762
pair orders
4765
4770
send pairing reports
4775
receive pairing reports
4777
receive pairing report
4780
receive pairing report

FIG. 100

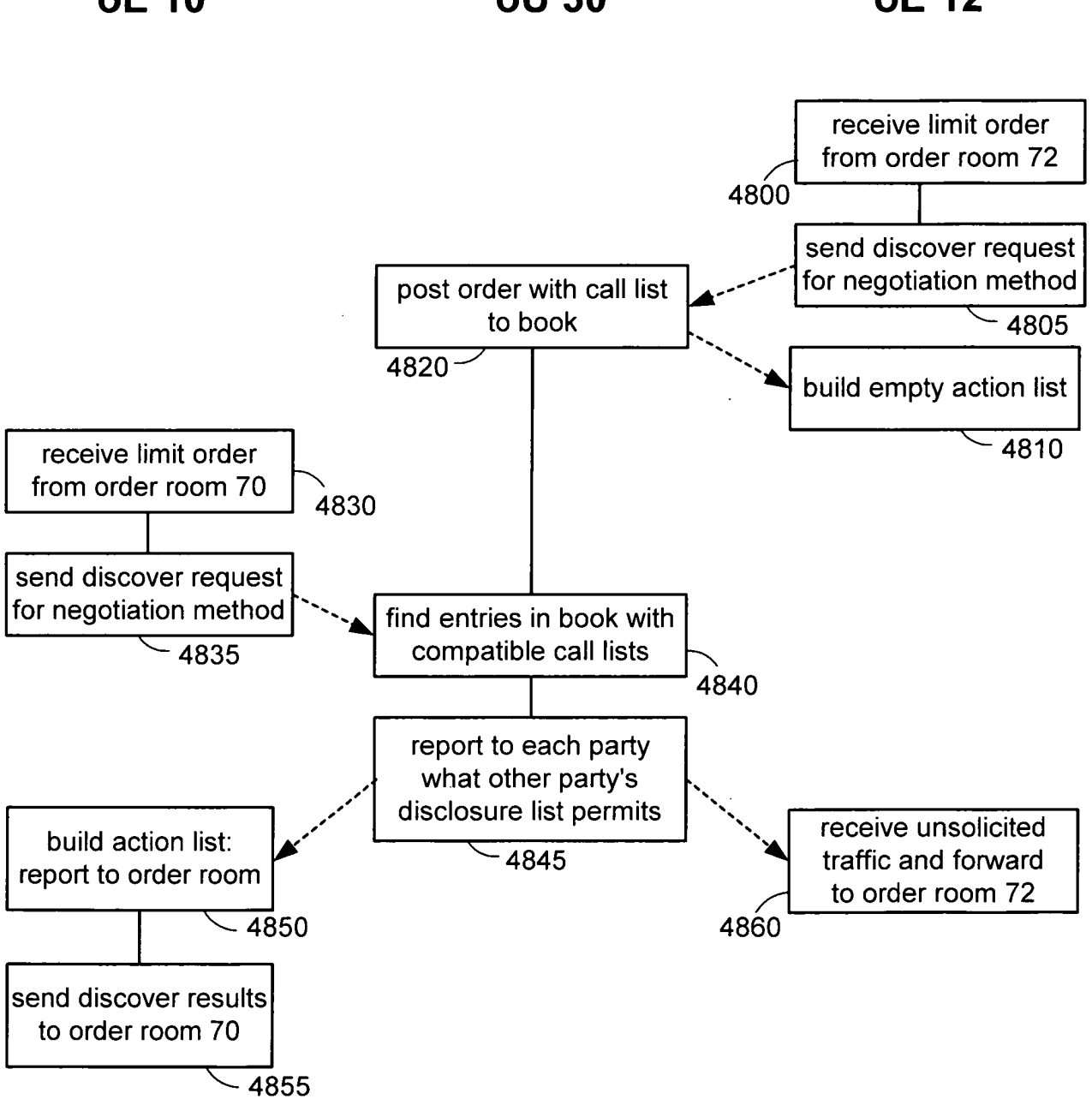

oE 10
oU 30
oE 12
receive limit order from order room 72
4800
send discover request for negotiation method
4805
post order with call list to book
4820
build empty action list
4810
receive limit order from order room 70
4830
send discover request for negotiation method
4835
find entries in book with compatible call lists
4840
report to each party what other party's disclosure list permits
4845
build action list: report to order room
4850
receive unsolicited traffic and forward to order room 72
4860
send discover results to order room 70
4855

FIG. 101

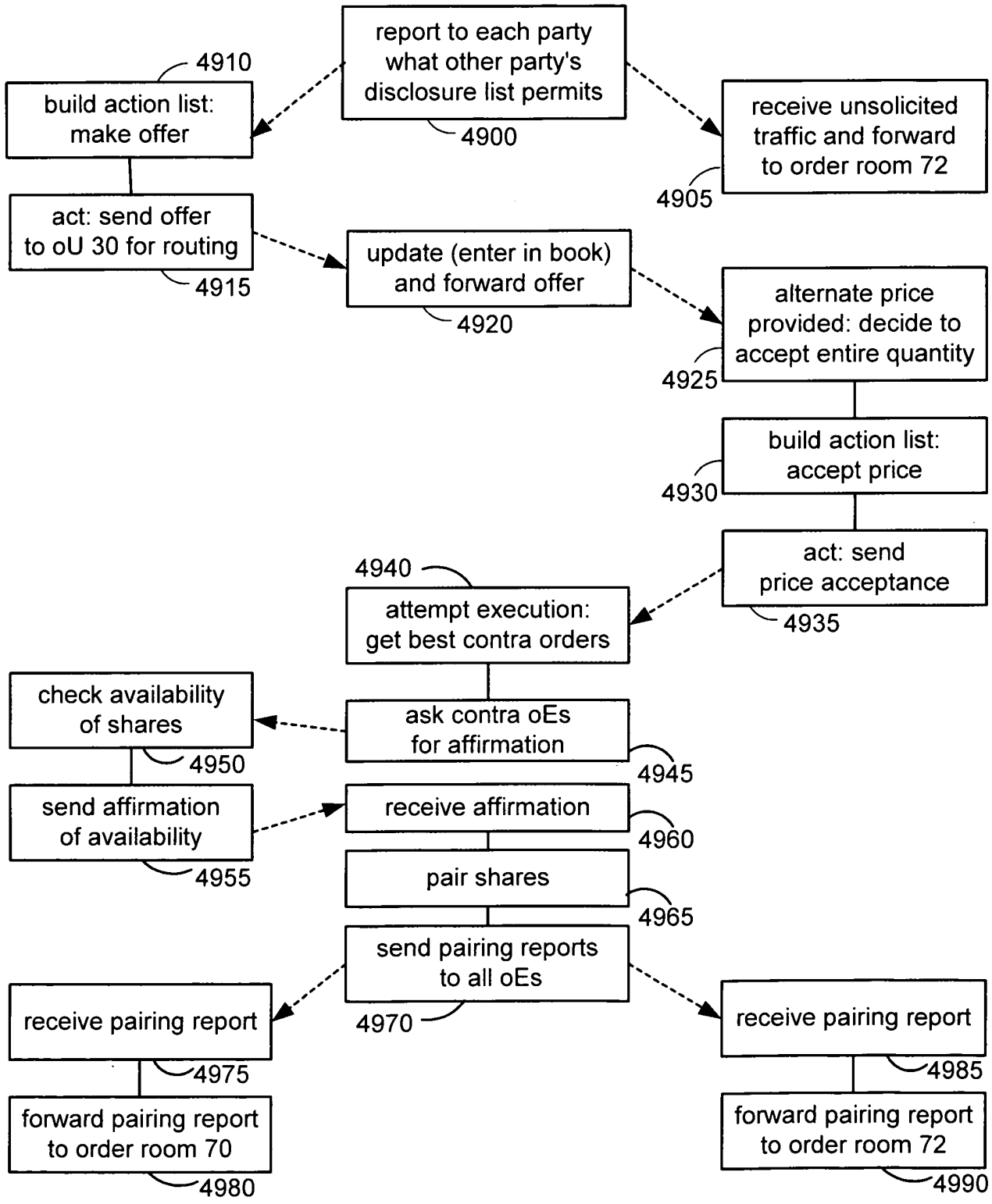

oE 10
oU 30
oE 12
report to each party what other party's disclosure list permits
4900
4910
build action list: make offer
act: send offer to oU 30 for routing
4915
update (enter in book) and forward offer
4920
receive unsolicited traffic and forward to order room 72
4905
alternate price provided: decide to accept entire quantity
4925
build action list: accept price
4930
act: send price acceptance
4935
4940
attempt execution: get best contra orders
ask contra oEs for affirmation
4945
check availability of shares
4950
send affirmation of availability
4955
receive affirmation
4960
pair shares
4965
send pairing reports to all oEs
4970
receive pairing report
4975
forward pairing report to order room 70
4980
receive pairing report
4985
forward pairing report to order room 72
4990

FIG. 102

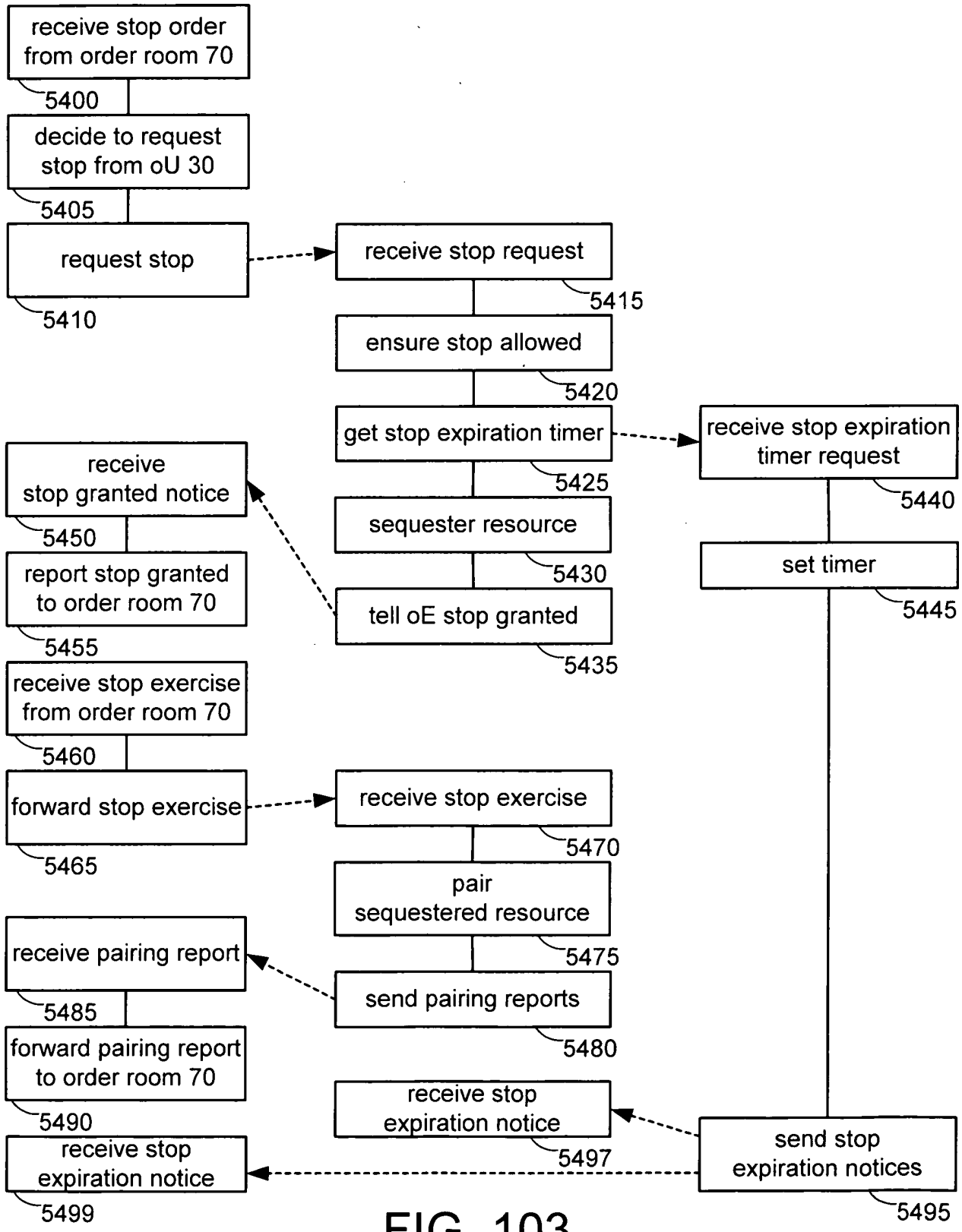

oE 10
oU 30
stop order mgr 67
receive stop order from order room 70
5400
decide to request stop from oU 30
5405
request stop
5410
receive stop request
5415
ensure stop allowed
5420
get stop expiration timer
5425
sequester resource
5430
tell oE stop granted
5435
receive stop granted notice
5450
report stop granted to order room 70
5455
receive stop exercise from order room 70
5460
forward stop exercise
5465
receive stop exercise
5470
pair sequestered resource
5475
send pairing reports
5480
receive pairing report
5485
forward pairing report to order room 70
5490
receive stop expiration notice
5499
receive stop expiration timer request
5440
set timer
5445
receive stop expiration notice
5497
send stop expiration notices
5495

FIG. 103